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ECONOMIC RESOURCES AND INDUSTRIES OF THE WORLD

BY

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ILLUSTRATED

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TO

DR. LUDWIG KOTANY

THIS BOOK IS DEDICATED

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PREFACE

A remarkable feature of the expansion of the industrial nations during the last thirty years has been their growing dependence on the outside world both for raw materials and for enlarged markets to absorb the increasing surplus of the home industries. While foreign trading is as old as the centuries the new feature which gives character to this age is the appearance in ever-growing proportions of economic interdependence.

The reasons are easy to understand. In the first place, the remarkable expansion of manufacturing industries in the four or five leading nations has created a growing surplus of manufactured products. Foreign markets are necessary to consume these products. On the other hand, the specialized demands for raw materials arising partly from diversified industries and partly from the more exact technical needs of manufacture make necessary the quest for materials in practically every region of the world. Economic penetration has become an essential condition not only for the further expansion of home industries, but for the development of the more backward regions to the point where they may yield their substances in abundance.

More and more the economic organization is losing its national character and is becoming international or world-wide. Hence, to understand completely the business enterprises of any one country, and this is notably true of the United States, it is necessary to survey some of the industrial changes which are taking place elsewhere. No nation can live unto itself. The newer, and more backward, parts of the world need the capital and the technical and business skill of those nations which have pushed forward most rapidly; and, on the other hand, the richer nations must have an outlet for their capital and enterprise. They must obtain many products which the less developed regions supply, and they need markets for the growing surplus of home manufactures. The richer nations must supply the shipping, the experience, the initiative, the banking facilities, and the business organization for the more general economic development of the world. Economically speaking, the regions of the earth are bound more closely than ever, and if we may judge by the trend of present development, many features of a real world economic organization are in the process of formation.

It follows from this statement that a study of any of the great aspects of our economic life leads inevitably into foreign fields. From all our great industries the lines of economic interest stretch in all directions to the producing and consuming regions far beyond our borders. This is true also with financial arrangements, whether for commercial or for investment purposes, because dependence on the external world makes necessary the investment of capital abroad. The world is now the realm for commercial and industrial exploitation. Not only are merchants and manufacturers penetrating into foreign parts, but we are exporting large amounts of capital and we are sending abroad technical experts of every description to aid merchants and manufacturers in their quest for business opportunities.

In organizing the material for this volume I have tried to keep in mind the needs not only of instructors in courses in world resources and industries, but of those who give work in foreign trade, including foreign investment in its various aspects. This volume contains much material of interest to teachers of world geography. While the emphasis is on economic matters, such as the effect of relative costs of production—the influence of the human factors of production, the effect of transplanted enterprise, among others—the discussion of necessity deals with location and extent of resources, the routes of materials to market, the conditions of development, and many other factors with which the geographer is familiar. I have stressed the economic effect of financial power, of ownership of ocean shipping, of organized systems of trade, and of exported enterprise as factors in the modern growth of world trade and industry. I have tried, also, to keep in mind the needs of teachers of economic history, and much of the material in this volume will be useful in history courses.

Part I contains a discussion of the factors in the development of the resources and industries of the world. I have devoted chapters to the present status of international commerce, the effect of human resources on the growth of trade and industries, the influence of human institutions, the effect of foreign investments on the development of resources, and the importance of a world economic organization.

Part II contains chapters which present the resources of the various parts of the world. Under this caption are included the products of forests, fields, mines, and waters. Since the minor metals are playing an important part in the success of modern industry, considerable attention is given to the supplies of such materials and to the conditions involved in exploitation.

Part III contains chapters on the industrial growth of various countries. Emphasis is laid on the economic conditions in the leading nations, but considerable attention is given to the more backward regions which are just beginning to be touched by the spirit of modern enterprise. I have presented the needs of such regions and have suggested the conditions requisite for their economic growth.

The present industrial age is one of the serious problems. Are the stronger nations the trustees of those who have not yet attained to the industrial stage? Since some of the weaker nations contain great stores of wealth which are shortly to be needed by the stronger countries, what should be the attitude of the stronger toward the weaker, and *vice versa,* of the weaker toward the stronger, with respect to access to essential raw materials? Some products do not exist in unlimited quantities. The mere expression "rarer" elements indicates that even now the supply is not large enough for present industry. What is the future of the industries which depend on such materials? What is the outcome of growing international economic competition? And, most important of all, is the present industrial age merely a passing phenomenon? These are questions not only for merchants and capitalists, but for ordinary citizens who are interested in national and world affairs. Hence the author hopes that not only the college student but the general reader may find some interest and profit in the following pages.

I. L.

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PART I

FACTORS IN THE DEVELOPMENT OF THE WORLD'S RESOURCES AND INDUSTRIES

ECONOMIC RESOURCES AND INDUSTRIES OF THE WORLD

CHAPTER I

WORLD COMMERCE AND INDUSTRY TODAY

Great differences exist among the various nations of the world in resources, in the character of the people, in wealth, and in the stages of industrial development. These differences largely account for the nature of the enterprise within their borders, and for the character of their foreign trade.

UNEQUAL DISTRIBUTION OF RESOURCES

Nature has distributed her resources very unequally over the world. In some regions the soil is exceedingly rich, in others it is so poor that the land must be carefully worked, or fertilized, before it will yield an adequate crop. Some very fertile regions are arid and can be adapted to the uses of agriculture only by irrigation. Other regions contain an excess of water, such as marsh and swamp land, and must be reclaimed by drainage. Vast stretches of the earth's surface are desert.

Another inequality in the distribution of resources is due to the presence of the climatic zones. The tropics are usually prolific of vegetable wealth. Many plants which thrive in such regions cannot survive in colder climates. Great quantities of raw materials which are consumed by manufacturing industries in the temperate zones are obtained from the tropics. The list includes a number of valuable timbers, rubber, gums, fruits of many kinds, some vegetable oils, certain food products and some medicinal plants, and fibers of many descriptions. The temperate climates, on the other hand, contain plant life which is peculiar to such regions. Further, some plants, like cacao, cannot exist in regions of winds; some, like the young coffee trees, require a good deal of heat and moisture, yet they cannot stand the blazing rays of the sun. The vegetable products thrive under a great variety of conditions—each kind makes peculiar demands upon soil and climate. Plant life is often most exacting in its demands upon nature, and the conditions must be met if the particular plant is to succeed. These natural differences are also a cause for the peculiar industries of some regions, and for the trade of such regions with the outside world.

The inequalities in the distribution of mineral products are even greater than is the case with plant life. Only two places in the world produce important quantities of platinum. Most of the world's supply of emeralds comes from only two places. No more than four regions are important producers of diamonds. The precious metals are a little more widely distributed, but, at that, over half the world's supply comes from a small region in South Africa, and another 30 per cent of the total is produced in a few regions in North America. The world's supply of tin comes chiefly from Bolivia, and from a few areas in the Far East. Iron ore is widely distributed, but there are great differences in the quantity and quality of the deposits. A few regions in the world, such as the so-called Lake Superior district in the United States, and small areas in western Germany, northern France, and in England yield by far the greater part of the world's output. Lead, zinc, and copper are also widely distributed, but the great deposits exist only in a few places.

These inequalities in distribution also apply to animal life. The finer furs, for example, come from the cold climates. Moreover, animal life is often dependent on certain kinds of feedstuffs; thus animal industry can thrive only where the appropriate grains and grasses can be produced most successfully.

Population and industries have sometimes developed at places which are remote from adequate supplies of raw materials. Some of the great manufacturing nations produce none of certain raw materials upon which their manufacturing industries are founded. These raw products must be imported. The western countries of Europe, for example, produce no cotton; yet the production of cotton textiles is an important industry in at least four of these countries. Many regions of the world are dependent on the manufacturing enterprise of Europe for the supply of cotton fabrics. Here, then, is a basis for trade, namely, the production of raw cotton in certain regions, and the consumption by others of cotton textiles.

Textile fibers, foodstuffs, and crude metals are among the greatest raw materials which enter international trade. But such commerce includes a vast number of commodities of lesser importance flowing into the great manufacturing areas for fabrication into innumerable articles. International trade also includes a long list of manufactured goods originating largely in the western countries of Europe, in the United States, and to some extent in Japan and India, destined for all parts of the world. England, France, Germany, Belgium, Holland, and Japan are large importers of raw materials, and great exporters of finished manufactures. The United States is one of the greatest exporters of manufactures, and it is becoming a great importer of raw products. In the case of France in 1923, 61.5 per cent of the imports were composed of raw and partly finished products; such imports into Belgium in 1926 amounted to 52.2 per cent of the total; into Holland, 36.6 per cent; into Germany, 47.8 per cent. On the other hand, manufactured articles sent out of Germany in 1926 amounted to 68.5 per cent of the total; from France in 1923, 67 per cent; from Belgium in 1926, 55 per cent; and from England 61 per cent. Crude materials and foodstuffs constituted 52 per cent of the total import commerce of the United States in 1926; and finished and semifinished manufactures amounted to 55 per cent of the total exports.

TRADE IN MANUFACTURES AND RAW MATERIALS

There is some relation between the resources of a region and its manufactures. But it is not always true that a nation cannot possess a manufacturing industry unless it produces within its own borders the raw materials. Moreover, many regions which produce raw products do not possess an important manufacturing industry using such materials. The newer parts of the world frequently confine their attention largely to production from mines, forests, and fields. These commodities are exchanged with the manufacturing nations for finished products and for various economic services.

Financial strength, and commercial and manufacturing organizations are important forces attracting commerce, and great magnets in drawing raw materials from all parts of the world. In all cases, the richer nations are large importers of crude products. This means that their industries are not necessarily based on the substances which they produce within their own borders. It would not be difficult to find many illustrations of this statement. Consider the case of cotton textiles in England. All the raw material is imported. A similar statement applies to the English industries which use jute, silk, and the products from which vegetable oils are manufactured, and it is largely true of the woolen industries, because England does not produce enough wool to supply her extensive manufacture. Some of the great nations of Europe manufacture products from copper, lead, and zinc, yet, in many cases, these materials are imported. Thus, it is not true that national industries depend on national supplies of raw materials. Nor is it true that a nation which produces raw products will always possess the manufacture into which the crude stuffs enter.

Of course, in the case of those countries whose chief enterprise is production from field and mine the presence of the resources is an essential condition to the rise of the industry. In Argentine, rich farming land is indispensable to the success of grain production and stock raising; and vast mineral deposits on the west coast of South America are the basis for the mineral-producing industries.

Financial strength and commercial organization will attract raw materials from all parts of the world. If the manufacturers and merchants of a country possess the purchasing power, and if they have the commercial and manufacturing organization, they can import the raw products needed for their industries. England affords an ample illustration of this statement. The varied industries of this country depend to a large extent on raw materials gathered up in all parts of the world.

WORLD COMMERCIAL EQUIPMENT: TRANSPORTATION

World commerce, whether within or outside national boundaries, depends absolutely on means of transportation. In practically every nation, the waterways, at one time or another, have been an important means of developing commerce. Great rivers, like the Mississippi and its tributaries, the Amazon and the Platte and their tributaries, the Rhine, Danube, Volga, Hoang Ho, the Murray, and the Nile, among others, have been important means of commercial intercourse. Particularly in the United States and Europe great sums have been expended upon the development and maintenance of these waterways, and in some cases they have been supplemented by extensive systems of canals.

The artificial channels between continents are a part of the world's commercial equipment. Considering the thousands of vessels that pass through these waterways each year these shorter routes not only save many thousand miles of sailing, but they greatly economize the capital invested in ocean shipping, and reduce the expenses of operation.

The Panama Canal may be taken as an illustration. This great work was begun in 1904 and opened for commercial traffic in 1914. The total cost was approximately $400,000,000. One great significance of this canal is the shortening of the sailing distance between the Atlantic and gulf ports of the United States and the Pacific coast ports. The canal also lessens the distance between the west coast ports of South America and the cities on the east coast of North America. A similar saving of time and distance is involved in commerce between European ports and the west coast ports of South America. The old route from New York to the ports of Chile was through the Straits of Magellan. By use of the Panama Canal the route from New York to Valparaiso is shortened by 3,747 miles, and to Iquique, on the north coast of Chile, by 5,139 miles. Between the east coast ports of the United States and the cities on the west coast the saving is much greater. From Liverpool to Iquique, the Panama Canal route saves 2,932 miles, and the saving from Hamburg to Iquique is 2,794 miles.

Commenting on these economies Professor Emory R. Johnson says:

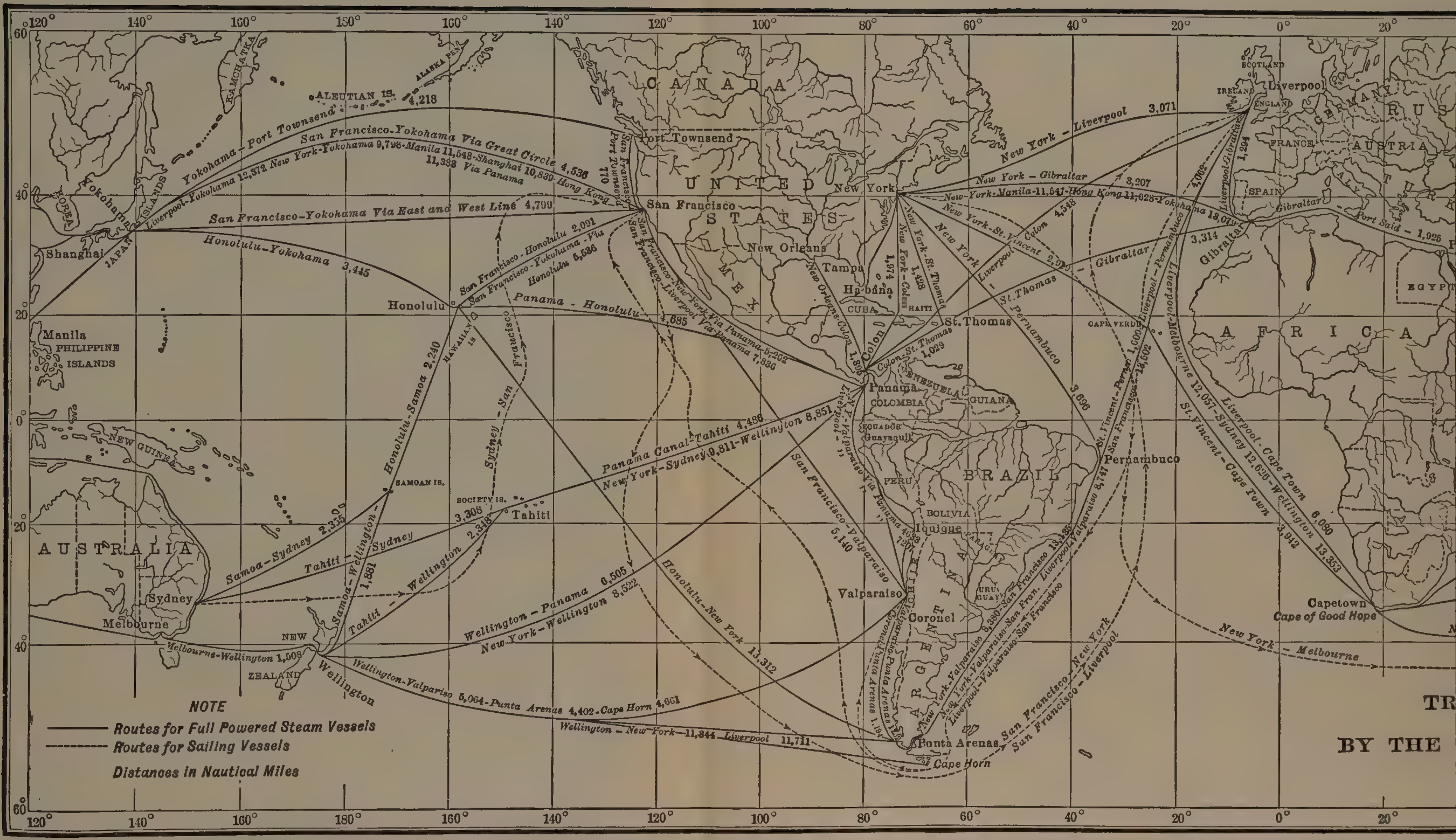
> The reduction in the time required to make an ocean voyage becomes of greater importance with the development of transportation facilities and services. Freight and passenger vessels become larger and more expensive, and thus require greater investments of capital; operating expenses for salaries, wages, and coal increase with rising wages and prices; and overhead expenses for office rents and for the personnel needed for securing and developing traffic grow larger. All this emphasizes the necessity of securing as many units of transportation service as practicable from each vessel operated. The shorter the length and time of each trip, the greater the number of trips that can be taken; and, as the rates charged by way of the longer route can seldom be made higher than by a shorter route, the shorter route is quite certain to be more profitable unless some special charges like canal tolls or transfer services should be so large as to offset the lower expenses and the higher efficiency of service by the shorter route.

A similar statement applies to the Suez Canal. The distance between London and Bombay by the old route round the Cape is about 11,220 miles; by the new route made available by the canal the distance is only 6,332 miles. Work on the Suez Canal was begun in 1859 and this waterway was open for traffic in 1869.

While the Kiel and Sault Ste. Marie canals do not cut passages through continents they rank with the Panama and Suez canals in importance as commercial facilities. The Kiel Canal, which is about 61 miles long, saves about 237 miles of troublesome navigation. This amounts to about three days for sailing vessels, and from twenty to twenty-five hours for ordinary steamers.

The canal at Sault Ste. Marie is an important feature in the commerce of the Great Lakes. From the point of view of tonnage which passes through the works it is the greatest canal in the world. For example, the freight carried through this waterway in 1926 amounted to 85,600,000 short tons; the freight through the Panama Canal the same year amounted to 31,600,000 gross tons, and through the Suez in 1923 to 22,700,000 tons.

In 1926 the total shipping owned by the principal maritime nations of the world amounted to 64,700,000 tons. The European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BY THE
NOTE
Routes for Full Powered Steam Vessels
Routes for Sailing Vessels
Distances in Nautical Miles
Yokohama – Port Townsend 4,218
San Francisco-Yokohama Via Great Circle 4,536
Liverpool-Yokohama 12,372 New York-Yokohama 9,798-Manila 11,548-Shanghai 10,839-Hong Kong
11,388 Via Panama
San Francisco – Port Townsend 770
San Francisco-Yokohama Via East and West Line 4,799
Honolulu–Yokohama 3,445
San Francisco - Honolulu 2,091
San Francisco - Yokohama - Via Honolulu 5,586
Panama - Honolulu 4,685
San Francisco-New York Via Panama 5,262
San Francisco-Liverpool Via Panama 7,836
Honolulu-Samoa 2,240
Sydney - San Francisco
Panama Canal-Tahiti 4,486
New York-Sydney 9,811-Wellington 8,851
Samoa–Sydney 2,335
Samoa–Wellington 1,881
Tahiti – Sydney 3,308
Tahiti – Wellington 2,348
Wellington – Panama 6,505
New York–Wellington 8,522
Melbourne-Wellington 1,508
Wellington-Valpariso 5,064-Punta Arenas 4,402-Cape Horn 4,661
Wellington – New York—11,844 Liverpool 11,711
Honolulu–New York 13,312
San Francisco–Valparaiso 5,140
N.Y.-Valparaiso Via Panama 4,633
Liverpool – " " 7,207
Valparaiso-Coronel-Punta Arenas 1,194
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New York – Liverpool 3,071
New York – Gibraltar 3,207
New York-Manila-11,547-Hong Kong 11,628-Yokohama 13,079
New York-St. Vincent 2,910
Liverpool-Colon 4,548
New York-Colon 1,974
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Colon-St. Thomas 1,029
St. Thomas – Gibraltar 3,314
New York – Pernambuco 3,696
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Liverpool-Cape Town 6,080
St. Vincent-Cape Town 3,942
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PERU
BRAZIL
BOLIVIA
Iquique
PARAGUAY
CHILE
ARGENTINA
URUGUAY
Valparaiso
Coronel
Punta Arenas
Cape Horn
Pernambuco
CAPE VERDE
SCOTLAND
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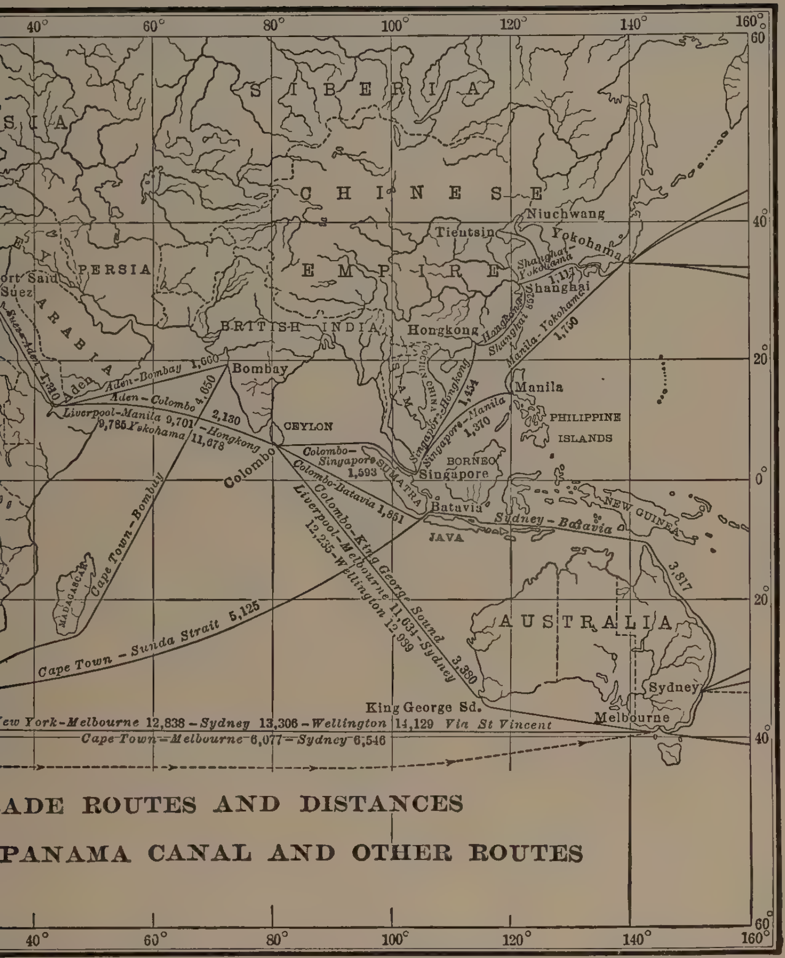
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NEW GUINEA
JAVA
Cape Town-Bombay
MADAGASCAR
Colombo-King George Sound 3,330
Liverpool-Melbourne 11,631-Sydney
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Cape Town - Sunda Strait 5,125
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ADE ROUTES AND DISTANCES

PANAMA CANAL AND OTHER ROUTES

countries are the greatest carriers of world commerce. Britain particularly possesses a large merchant marine. In 1926 this amounted to about 30 per cent of the total. This shipping not only yields a large revenue to the owners at home, but it is one of the great elements in the industrial strength of Great Britain. Some of the smaller countries possess a large tonnage. This was the case with the Netherlands which reported 2,552,600 tons, with Norway which possessed 2,806,000 tons, and with Sweden with 1,294,000 tons. It is apparent from these figures that the enterprise which carries the largest part of world commerce is located in the countries in western Europe.

Today the United States carries a considerable proportion of its own commerce. In 1926, for example, 34.6 per cent of our exports were carried in American vessels, and 30.7 per cent of the imports. This is a marked change compared with 1914 when only 11.4 per cent of the imports and 8.3 per cent of the exports were carried in American ships.

Railway mileage is very unequally distributed over the world. Some of the most populous countries are very inadequately served. The total for the world in 1926 was about 700,000 miles; of this about 261,800 miles were in the United States, and 242,700 miles were in Europe. Remarkable illustrations of lack of railway facilities are found in the cases of India and China. The latter country in 1924 contained only 8,212 miles in a territory aggregating about 4,300,000 square miles, with a population of more than 442,000,000. The mileage of railways in India the same year was 38,580. The area of this country is about 1,805,300 square miles and the population about 318,000,000. In South America the railway net is densest in the regions about Buenos Aires, Santos, and Rio de Janeiro. This region contains nearly 80 per cent of the total railway mileage of South America, which in 1926 amounted to about 55,500 miles. In Africa the region of most extensive railway building has been in the Union of South Africa, which in 1926 contained 12,400 miles. There were only 1,970 miles in Egypt. The lack of railway transportation is one of the most serious handicaps in the development of these regions. Unfortunately this condition exists in some of the most populous regions of the world.

WORLD COMMERCIAL ORGANIZATION

Commercial organization includes not only means of communication, such as railroads and ocean shipping, but financial and mercantile organization as well. Practically all the world's commerce must be financed. Merchants everywhere buy on credit. Sometimes the terms must be long. This is particularly the case with countries whose industries are seasonal. The income is produced when the crop is harvested. Meanwhile, consumers buy from the stores the year round. Since merchants cannot pay until their customers market their products, credit must be extended until this income is obtained. Thus, much of the world's international commerce must be handled on long terms of credit. Not infrequently the term of credit runs from 90 to 180 days, and in many instances through a system of open accounts or post dating, for even a longer period.

The conduct of trade on this basis requires an extensive banking organization. Thus, scattered throughout the world are branches and agencies of home banks which handle drafts for home merchants, gather credit information, serve as depositories for funds, and supply the means for buying and selling. Such aids are indispensable for the development of international commerce. The trading nations have built up an intricate system of credit institutions which perform this work more or less effectively.

Not only does international trade require commercial capital —to aid merchants and manufacturers in buying and selling— but investment capital as well. The international bankers of the lending countries have developed an extensive organization for assembling funds from those who save and for lending such funds for long periods to governments, and to capitalists for investment in railroad building, harbor improvement, and for the exploitation of mines and plantations. Investments of this kind are one means by which the countries which are great producers and savers of wealth lend financial aid to the poorer countries.

Not infrequently the great corporations of the industrial nations supply capital for investment abroad. This often takes the form of the building of plants and factories, the construction and equipment of warehouses abroad, the development of mining property, and the maintenance of distributing agencies, to name only a few of the foreign activities of such companies.

All such investments are worked out finally through the intricate machinery of foreign finance. Such investment would be difficult, if not impossible, without adequate banking service. Thus the world financial organization now makes provision for relatively short-time credit to aid merchants and manufacturers in buying and selling, and for long-period investments involving the transfer of capital to all parts of the world.

International commerce is now served by other important agencies. The purpose of some of these is to reduce the risks of trade, and to provide business information about conditions over the world. This latter task is often undertaken by the more enterprising nations because governments have more widespread contact than is possible with business houses, and therefore such governments have access to sources of information which is denied to the ordinary business enterprise. Moreover, much of this information is of a general nature; it is very helpful for the development of trade in general, but it is not definite enough for use by any particular enterprise, unless supplemented by other kinds of knowledge.

One of the important functions of the Bureau of Foreign and Domestic Commerce, connected with our own Department of Commerce, is to assemble foreign trade information. England, France, Germany, and Belgium, to name only the more important countries, maintain trade information service like that of the United States.

Every cargo that goes to sea carries a risk. During the last two centuries there has developed an adequate system of insurance to cover cargoes and vessels on the high seas; and there is now in existence a system of law applying to such risks. By reducing risks, by salvaging losses, and by giving confidence to maritime ventures these marine insurance organizations render a great service to overseas shipping. But modern commerce requires other facilities. Ocean cables, wireless communication, convenient coaling and oiling stations are an indispensable aid for the progress of foreign trade. In recent years, foreign chambers of commerce have begun to render an important service. Such organizations often establish contact between merchants in home and foreign countries, collect trade information, and not infrequently help to settle commercial disputes. The world commercial organization is therefore made up of a number of branches of service which work together more or less effectively to promote the aims of international business enterprise.

CENTERS OF WORLD FINANCIAL AND INDUSTRIAL ENTERPRISE

The enterprise which now promotes the development of world resources and the expansion of industries is localized in a remarkably small area. The source of most of this energy is in a few of the countries bordering on the north Atlantic Ocean. The funds, or credit, for this work are supplied chiefly by the United States, England, and France. Before the war Germany was an important factor in the supply of investment funds and commercial credit. Some of the smaller countries, like Belgium and the Netherlands, now contribute materially to this work. The capital supplied from these limited areas not only owns and operates the shipping, and directs the banking arrangements, but supplies the funds and the business enterprise which are now promoting economic development in many parts of the world.

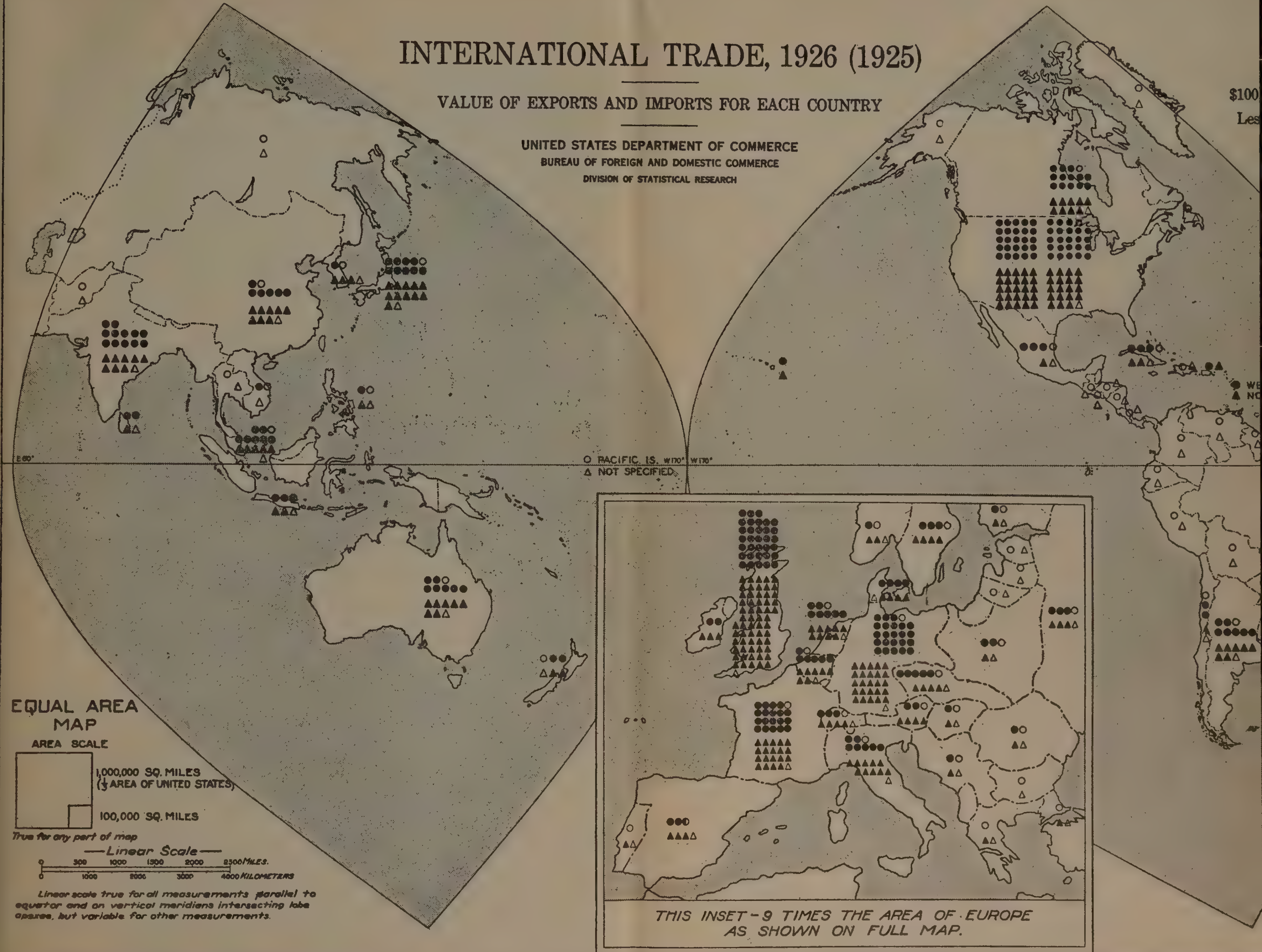
The world's industrial activity, as represented by modern factory production, is as strongly localized as the financial enterprise. The great centers of factory production are comprehended in a relatively small area in England, in western Europe, and in eastern and central United States. Portions of Japan, and regions about Calcutta and Bombay in India are areas of lesser importance. The remainder of the world looks to these few areas for products of iron and steel, for electrical machinery and supplies, for implements of all descriptions, for many kinds of textiles, and for chemicals, to say nothing of hundreds of manufactured specialities, and other articles peculiar to the genius of these countries.

Great streams of factory products flow out of these areas to

INTERNATIONAL TRADE, 1926 (1925)

VALUE OF EXPORTS AND IMPORTS FOR EACH COUNTRY

UNITED STATES DEPARTMENT OF COMMERCE
BUREAU OF FOREIGN AND DOMESTIC COMMERCE
DIVISION OF STATISTICAL RESEARCH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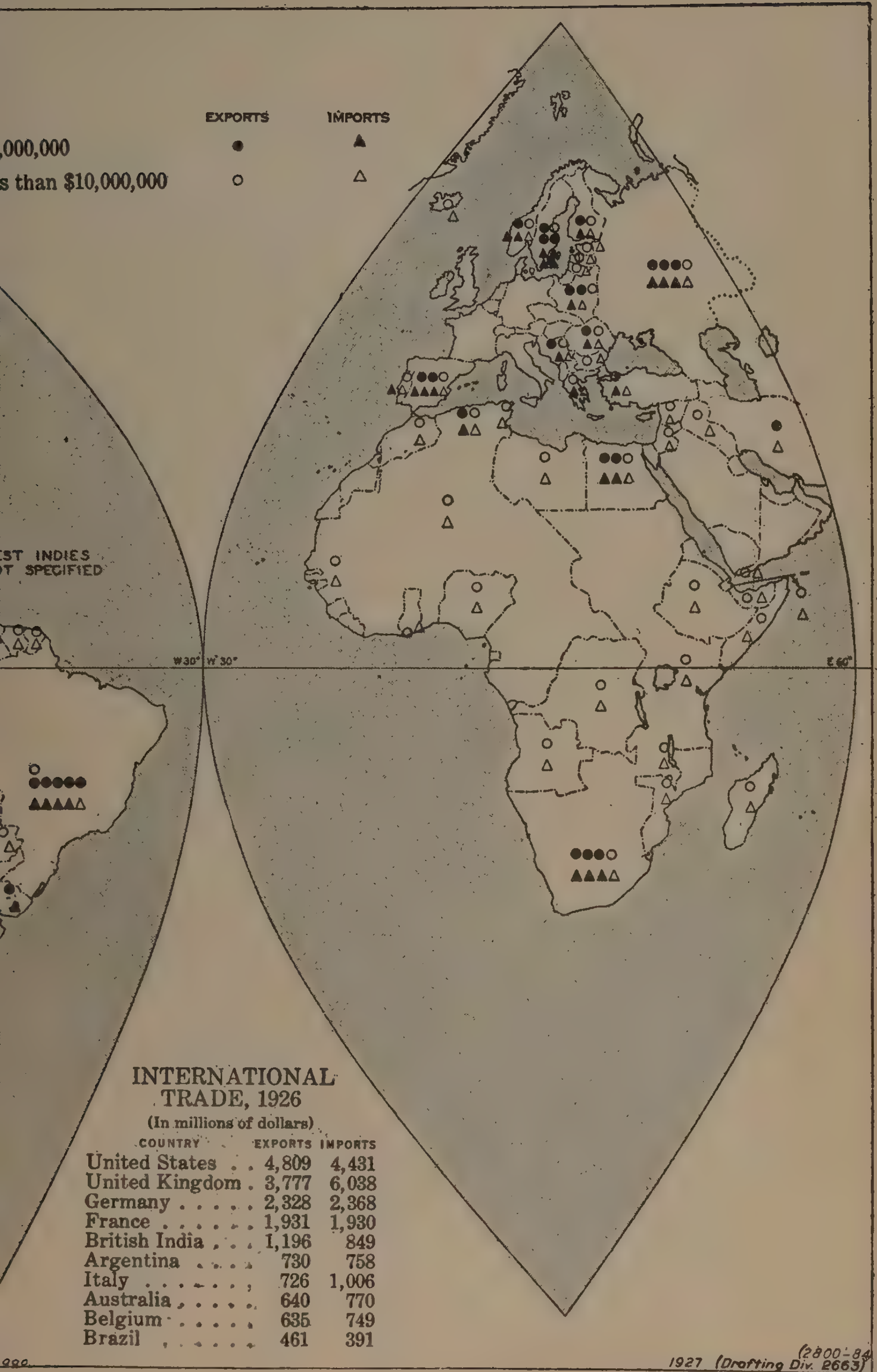
THIS INSET – 9 TIMES THE AREA OF EUROPE AS SHOWN ON FULL MAP.

Linear scale true for all measurements parallel to equator and on vertical meridians intersecting lobe apexes, but variable for other measurements.

Designed by United States Coast and Geodetic Survey.

This projection suggested by the homolographic maps previously designed and published by J. Paul Goode, University of Chi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INTERNATIONAL TRADE, 1926

(In millions of dollars)

COUNTRY	EXPORTS	IMPORTS
United States	4,809	4,431
United Kingdom	3,777	6,038
Germany	2,328	2,368
France	1,931	1,930
British India	1,196	849
Argentina	730	758
Italy	726	1,006
Australia	640	770
Belgium	635	749
Brazil	461	391

the other parts of the world; the return stream is made up largely of many kinds of raw products. It naturally follows from this industrial condition that the regions named above are the great centers of world commerce. In 1926 the value of the imports and exports of the United States, England, France, and Germany comprised about 43 per cent of the total for the entire world. Expressed in other terms, about 15 per cent of the population of the world—which is located in the countries just named —is responsible for about 43 per cent of the world's foreign trade. This is one indication of the character of the business enterprise of these areas compared with that of the rest of the globe.

A remarkably small per cent of the world's population produce goods by mechanical devices. Possibly not more than 15 per cent of the people of the earth come under the domain of the factory system. Except for small areas, that system has scarcely come into existence in the very populous continents of Asia and Africa, and it is used only to a small extent in South America. Even in portions of Europe many persons supply at least a part of their wants by hand labor aided only by simple mechanical devices.

This means that the great majority of the people of the world work with most inefficient methods of production. Their creative power is low. Although their labor is hard, they obtain for their efforts only small quantities of goods. The per capita wealth is small and the standard of living is low, compared with that of the United States and Great Britain. These conditions suggest the enormous possibilities for the industrial development of the future when the more backward people will be better supplied with as effective means of production as exist in the United States or in western Europe.

The value of the factory output of the four leading manufacturing nations is probably greater than the output by whatever method of the other peoples of the world. In 1923 this output for the United States was valued at $60,555,900,000. A recent census (1924) of the United Kingdom indicates that, excluding industries with an output of less than $45,000,000, the manufactured product amounts to about $11,000,000,000.

PRESENT VALUE OF WORLD TRADE

In a later section we shall discuss at some length the present status of the world's commerce. It is clear from what has been said above that a relatively small part of the world is the center of a large part of the foreign trade activity. But this statement does not tell the whole story because it says nothing about the volume of domestic trade; in the case of the four countries named above the domestic business is many times greater than the external commerce. The extent of industrialization in these regions, as compared with the rest of the world, is therefore much greater than it appears to be from a mere statement of the foreign trade activity. In 1926 the total value of the international trade of the world was about $60,400,000,000. The accompanying table shows the distribution of this commerce.

Foreign Trade of the World by Grand Divisions, 1926
(000,000 omitted)

Division	Imports	Exports	Total
Europe	$16,111	$12,840	$28,951
North America	5,487	6,012	11,499
Caribbean	685	873	1,558
South America	1,659	1,856	3,515
Africa	1,365	1,266	2,631
Asia (excluding Russia)	4,873	5,465	10,338
Oceania	983	952	1,935
Total	$31,163	$29,264	$60,427

DISTRIBUTION OF THE WEALTH OF THE WORLD

It follows from the facts presented above that the wealth of the world is very unequally distributed among the nations. This term is used in the sense of productive equipment, buildings, exploited land and resources, and personal effects. The extremes are found in the case of the United States on the one hand, with its high total and per capita wealth, and on the other, in portions of Africa and Asia with very low quantities in both these respects.

Millions of people in vast areas of the world live in what we would call extreme poverty. They work with the crudest implements, and even with most laborious effort find it difficult to supply simple wants, much less create savings. There is no necessary relation between the size of the population of a country and the extent of its developed wealth. In fact, the wealthy countries are those which possess effective industries with highly developed mechanical aids. Such systems have made human labor much more productive than is the case in the poorer countries. Years, sometimes centuries, have been required to attain to this high stage of mechanical perfection. But the nations which have reached this stage are now reaping the benefits of high productivity, and in consequence they enjoy great opportunities for both consumption and saving.

Acceleration in the production of wealth, and in saving, is in direct relation to the growing introduction of mechanical aids. With all the enterprise, it took the American people several hundred years to get ready for the brief period of rapid accumulation of wealth which began about 1880. In that year the total wealth of the United States was only $43,642,000,000; within forty years it has grown to $320,804,000,000 (1922). In the same period the capital invested in manufactures increased from about $2,790,000,000 to $44,466,000,000. Since the latter figures show the value of productive equipment they convey some idea as to how well our people were prepared for the creation of wealth in 1920 as compared with 1880.

The significant feature is that so many years were required as preparation for the rapid expansion which occurred in only forty years. This suggests that the more backward peoples of the world, and this includes some of the densely populated areas of China and India, must experience a similar period of preparation and waiting, unless they receive material aid from the richer countries.

The richer countries are highly industrialized. This statement includes the United States, United Kingdom, France, Germany, the Netherlands, Belgium, and portions of Japan. Here and there throughout the world are other industrial centers of some importance, but the magnitude of their industries is small compared with that of the countries just named. From these richer countries capital in various forms flows into the poorer regions of the earth. This capital usually takes the form of machinery, materials, and supplies.

Per capita wealth is greatest in the United States. It amounts to about $2,919; in the United Kingdom it is $2,662; in Germany, $916; in Japan, $890; and in China, $137. In many regions the per capita wealth is only a few dollars. This signifies that the people display not only low standards of living, but also a low degree of productive effort. An estimate of the national wealth of various countries is presented in the accompanying table.

Estimate of the National Wealth of Various Countries
(000,000 omitted)

Country	Estimated Wealth	Country	Estimated Wealth
United States	$320,804	Union Soviet Republics	$52,000
United Kingdom	120,000	Canada	22,000
China	60,000	Italy	22,000
Germany	58,000	Brazil	16,000
Japan	53,200	Argentine	15,000
France	52,000	Australia	14,000

EFFECT OF COLONIAL POWER

The flow of capital and enterprise to the more backward regions is facilitated by the development of colonial empire.

While it is true that capital moves rather freely from one country to another, yet the more stable governments receive the greater benefit. Among other things, colonial possession assures to the capitalists of the investing countries that stability of economic and political conditions which encourages investment. At this point we do not raise the question as to political rights, and the freedom of people to develop their institutions in their own way. Our sole purpose is to indicate that colonial possession is a great aid both in the economic development of the colonies, and in the industrial and commercial growth of the home country. The great colonizing powers today have entered upon vigorous programs of development for their possessions. This involves the building of roads and railways, the opening of mines, the development of plantations and of other resources, and in many cases the founding of industries. This is one way in which the capital of the stronger nations is made available for use in those which are not thus favored.

Colonies are often a great asset to the home country. In 1919, for example, the possessions contributed more than 33 per cent of the total external trade of Britain. In 1926 almost half the imports into India and Australia came from the United Kingdom. This preëminence of the home country in the trade of the dominions is due in part to favored treatment, such as preferential duties on imports, but it is also largely due to the fact that the roots of the commercial and industrial organization are in the home country. The latter largely finances the trade, organizes the factors of the market, and carries the freight. Not infrequently the large debts of the colonies arising from these services are paid in exports to the home country, and this, of course, means trade.

Great Britain is the greatest colonizing power. Webster's famous phrase about the British drumbeat welcoming the rising sun around the world is as true today as during the life of the orator. The British Empire includes some of the most promising parts of the world. The great commonwealths of Canada, South Africa, and Australia have received enormous aid from England in the form of capital and industrial direction. The same is true of India. The Empire of Britain covers approximately 14,000,000 square miles, and includes over 400,000,000 people.

While less extensive than those of Great Britain, the colonies of France are scattered over the world. These dominions include some 4,124,000 square miles with a population of over 54,000,000. Algeria, Tunis, and Morocco are important possessions in North Africa. French dominions also include Senegal, Mauritania, French Sudan, Guinea, the Ivory Coast, and Zinder Territory. Madagascar and the Comoro Islands are other possessions. French dominions also include portions of Indo-China, French Guiana on the north coast of South America, and numerous islands throughout the world. Some of the smaller nations claim dominions which are not only more extensive, but more populous than the home country. The dominions of the leading countries are summarized in the following table:

EXTENT OF COLONIAL DOMINIONS OF VARIOUS COUNTRIES

Country	Area of Dominions (square miles)	Population
Great Britain	14,000,000	400,000,000
France	4,124,500	54,555,000
Holland	818,260	48,028,000
Portugal	824,800	8,734,000
Belgium	960,000	10,000,000
United States	741,000	10,000,000
Japan	116,500	22,000,000
Italy	584,000	1,620,000
Spain	148,600	649,000

INTERNATIONAL INTERDEPENDENCE

The interdependence of the various parts of the world extends to much more than the consumption of each other's products. The richer countries not only receive raw materials and supplies from other parts of the world, and export manufactures, but they provide enormous sums of capital, and they often contribute the engineering and industrial talent which is necessary for the development of resources and for the founding of industries. Through colonial dominion the stronger countries assure political stability which not only protects property but gives the peoples of the colonies a chance to develop. Of course, in spite of such fine phrases as "trusteeship of the less favored people" the home countries are not moved altogether by a spirit of philanthropy. Their guiding forces are often the quest for profits and the upbuilding of national political power. Moreover, the merchants and manufacturers at home hope that in time the colonies will become great consumers of their commodities and great producers of necessary raw materials.

The pervasiveness of the international economic relation is not usually understood by the ordinary student. It may be presented by a simple illustration. If one could look with the eye of imagination into the room in which the daily meals are served he could see the flags of many nations. The American flag would be there, of course, because many of the commodities in that room are of domestic production. The coffee on the table may have come from Brazil, or from Guatemala, or from Colombia. Thus, in imagination, the flags of those countries may be seen.

Or the drink may be tea. In that event, the flag which represents the product may be that of China, Japan, India, or Ceylon. The tablecloth and napkins may have been produced from linens which were fabricated in Ireland, Scotland, France, or Belgium. The wool in the rugs, or in the garments, may be partly domestic, but in all probability some of that commodity has been imported from Argentine or from Australia or South Africa. The silk in the clothing may have come from China, Japan, France, or Italy. The diamonds in the jewelry may be the product of South Africa; the emeralds from Colombia in South America; the platinum from the Ural Mountains in Russia or from Colombia, and the gold from America, South Africa, or Australia, to name only a few of the possible sources.

In one way or another the skill of hundreds of different classes of artisans was required to equip the room and to supply the family with food and clothing. For example, the sheep in Argentine or Australia were grown and protected against vermin and disease. This was the work of the farmer; but the previous labor of numerous trades equipped this man before he could render the service of growing sheep. Baling and shipping the wool involved other classes of labor. These processes required craftsmen in the production of gunny sacks and steel, to say nothing of the work of farmers in India who produced the jute, and that of the various artisans who built and operated ships and railway cars which transported the wool to market. Then the wool was washed, combed, spun, and woven. Thus, other craftsmen performed their tasks. Thence the finished fabrics moved through the channels of trade in which sales, advertising, and clerical force did their work. A similar routine describes the production and marketing of platinum, coffee, tea, linen, and other articles in the dining room.

International interdependence grows with the development of trade and industry. Even primitive man was dependent to some extent upon the efforts of his fellow men. In early times there was some trade between the tribes, and not a little piracy and theft. The complex system of modern production and exchange makes necessary a kind of division of labor in which different regions produce the things in which they have an advantage, and exchange with other regions which are working on the same principle. This advantage may lie in the abundance of certain physical resources; but it may also consist of artistic talent, or producing skill; sometimes it lies in the possession of wealth and in the financial and industrial organization which such possession makes possible.

With the evolution of industry the demands which industry makes on men and nature become more exacting. Skill becomes highly specialized; and materials must suit the exacting needs of the producer. The properties of manufactured steel, for example, must be adapted to the uses to which the steel is put. The composition of the razor blade is different from that of the structural beam, and this in turn differs from the quality of the steel in the surgical instrument, in the armor plates of the battleship, and in stainless steel, to name only a few kinds. Some forms of the finished metal require rather rare elements and these are seldom found in the same regions of the earth as iron deposits. Producers, therefore, must scour the world for the materials which suit the specific needs of their industries. This statement applies to many kinds of manufactures. Thus, its growing complexity, with its more exacting demands for materials, makes industry dependent on the outside world.

In some instances one raw material may be a critical element in the industry, and this key material may be produced in some remote part of the earth. The inability of the manufacturer to obtain this substance may be a serious handicap to his business. We tremble to think what would happen to the automobile industry if producers were denied a supply of rubber. Nickel, tungsten, vanadium, dyestuffs, and a considerable number of other products are keys to certain industries. These are only illustrations of the many kinds of needs of manufacture. Thus, as industry develops, the world becomes the source of raw materials, and on the other hand, the world is the market for finished products.

QUESTIONS

1. In what ways does the inequality of distribution of natural resources affect industrial activities within a country? How do these inequalities affect the relations among countries?

2. Can countries which produce the same product, as, for example, wheat, trade with each other in that product? Why?

3. The United States is the largest world producer of iron ore. But we also import iron ore. Can you give the reasons?

4. Explain how population and industries can develop at places which are remote from sources of raw materials.

5. There is some relation between the physical resources of a region and its manufactures. What is this relation?

6. Is it possible for a nation to develop extensive manufactures of certain commodities, such as cottons, if it does not produce the raw materials which enter into those manufactures?

7. Why do not the newer parts of the world which sometimes possess diversified resources also develop diversified industries?

8. Explain how "financial power is a great magnet drawing raw materials from all parts of the world."

9. Estimate the commercial importance of (*a*) the Panama Canal; (*b*) the Suez Canal; (*c*) the Sault Ste. Marie Canal.

10. Why are the European nations the greatest carriers of the world's commerce?

11. Does the ownership of shipping promote trade with the home country?

12. In 1914, less than 12 per cent of the imports and exports of the United States were carried in American-owned vessels. Did this condition put us at a disadvantage in the development of foreign trade?

13. Should a nation subsidize its merchant marine, if it cannot be developed without subsidy? Why do some nations find it necessary, and desirable, to grant such subsidies?

14. Why must much of the foreign trade be handled on long credits? What international banking arrangements are made necessary by this condition?

15. Why have only a few nations of the world introduced the factory system?

16. Account for the great inequalities in the distribution of wealth over the world.

17. In what form is capital often exported from investing countries?

18. Are colonies an asset or a liability to the home country?

19. Is the home country an asset or a liability to the colonies?

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CHAPTER II

THE HUMAN RESOURCE

The quantity and quality of the work which the people of a region or nation perform are the products of many variables. Human resources are probably more diversified than natural products. Even in a small community the inhabitants differ greatly in talent, skill, and in capacity for work and progress. This is most obvious to anyone who is given to observation. In fact, the stage of industry to which a people attain is the product of many factors, and peoples and regions differ greatly in this respect. The great differences over the present world, in social conditions, in grades of civilization, and in stages of industrial advance, are due to the fact that the components of these variables have functioned in vastly different ways in different places.

GENERAL CONDITIONS OF ECONOMIC PROGRESS

Speaking in general terms it may be said that the description of the economic life of any region depends on the character of the people, the nature of the physical resources, and the kind of social institutions which the people create. This statement, however, conveys no idea as to the interaction of these elements, nor is it intended to indicate whether one is more important than the others. Indeed, no such indication can be made, because all three conditions function together to produce the general character of the activities of a people. These factors are compounded in one way in the United States, and in quite a different way in India, and in still a different manner among some of the primitive tribes of Africa.

In America, in pre-Columbian times, about 150,000 Indians found difficulty in eking out a meager living in the country east of the Mississippi River. At the present time more than seventy million people live comfortably in the same area. The four hundred million Chinese have an enormous potential market, yet less than one-third as many Americans created a market of vastly greater proportions. Numbers are not necessarily a dominant factor in the production of wealth, although when industry is highly developed a large population supplies the labor needed for production, and creates the market for the products through its activities in consumption. Moreover, a country with a highly developed industry can sustain a much larger population than one which is lower down in the scale in industrial progress.

In some cases large numbers, or great density of population living in a given area, may be a serious disadvantage. This is usually the case with people living on a relatively low economic stage, where the population is close to the margin of subsistence. A poor crop, due to drought or the ravages of insects, may diminish the food supply to such an extent that a considerable portion of the population is confronted with starvation. For years, the inhabitants of a certain section of India lived under this threat. On the other hand, a nation in the more advanced stages of industry protects itself against such hazards. For example, a railroad, or an improved river, may prevent disastrous conditions due to poor crops by making possible the transportation of the surplus of one area to another which suffers loss.

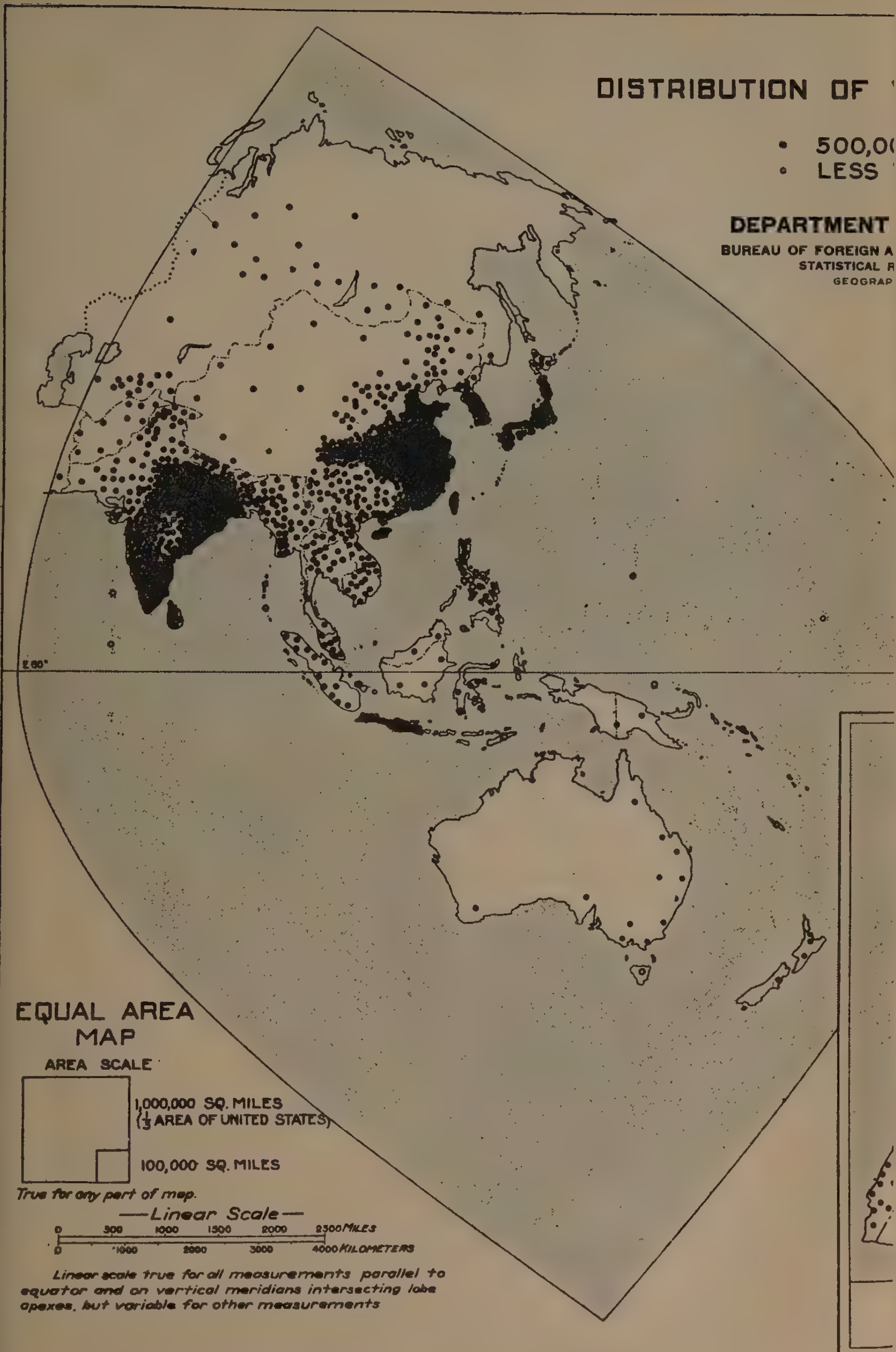
EFFECT OF THE DEVELOPMENT OF THE ARTS AND SCIENCES

The human element, as a factor in economic progress, expresses itself more and more with the development of the sciences and with the growth of the arts of business. Water power was once a leading factor in the localization of manufactures, and to some extent today factories are built on power sites. But with the development of electricity, power which is generated at some site, may be transmitted long distances to consumers. In many instances it is possible to reproduce desirable natural conditions in homes and factories. To this extent man is freed from the exactions of nature.

Nor is this all. Under modern industrial arrangements man modifies the conditions under which nature renders its service to industry. The railroad-builder tunnels mountains, bridges streams, and cuts down natural grades over which the line is to be built. We may say with some measure of truth that modern technical knowledge has enabled man to manufacture natural conditions. Worn-out land is restored to productivity through the application of fertilizers produced in a factory; swamp lands are drained by mechanical means; dry land is irrigated; forests are replanted; and game is restored to its natural habitat. Mining engineers are discovering methods for the extraction of metal from low-grade ores, thereby making natural products much more available.

With the application of scientific methods man has been able to greatly modify original natural conditions. Human beings obtain their living from nature, but in many respects they determine the way in which that living is to be made. In this connection, science has devised many substitutes for original natural products and has thereby diversified the conditions of life and has rendered living much more certain than in former times.

The original natural advantages of certain regions are being constantly modified by human effort. For example, intercontinental canals, like the Panama and Suez, take away the former natural advantages of certain places and bestow benefits upon others. The United States is expected to become the great beneficiary of the Panama Canal, and it is predicted that certain European countries will lose their relative positions in the trade of the west coast of South America, and to some extent with the Far East. Moreover, these canals take away the handicaps of distance which nature originally imposed. A new railroad may change the direction of commerce, as was the case with the building of the early trunk lines in the eastern part of the United States. When commerce was limited to the natural waterways it was compelled to follow the direction of the streams—largely north and south—but the railroads enabled trade to seek the shortest distance to the seaboard markets. A change in the system of railroad rate-making may take away the natural advantages of certain communities and transfer the benefits to other places.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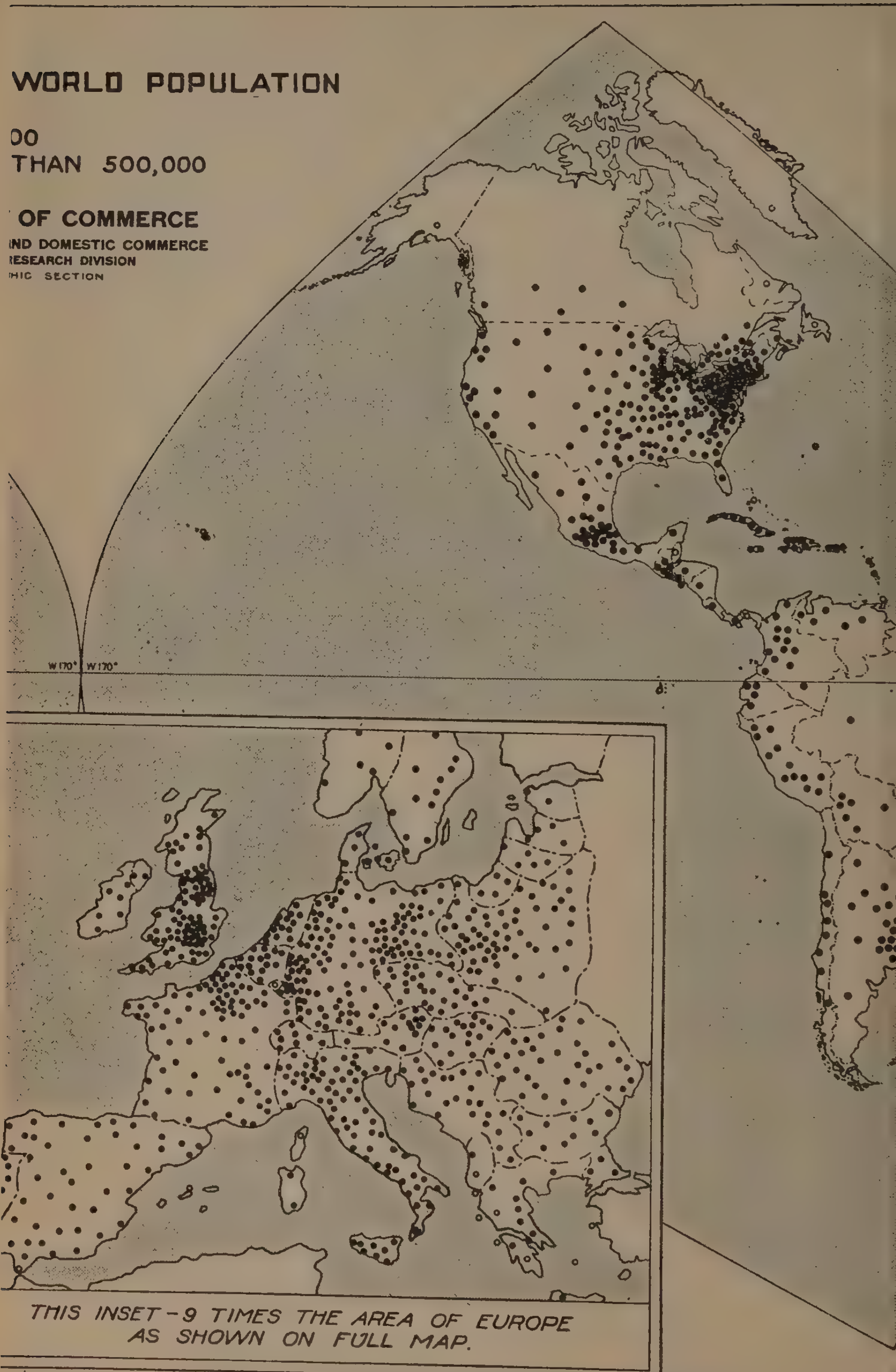

THIS INSET – 9 TIMES THE AREA OF EUROPE AS SHOWN ON FULL MAP.

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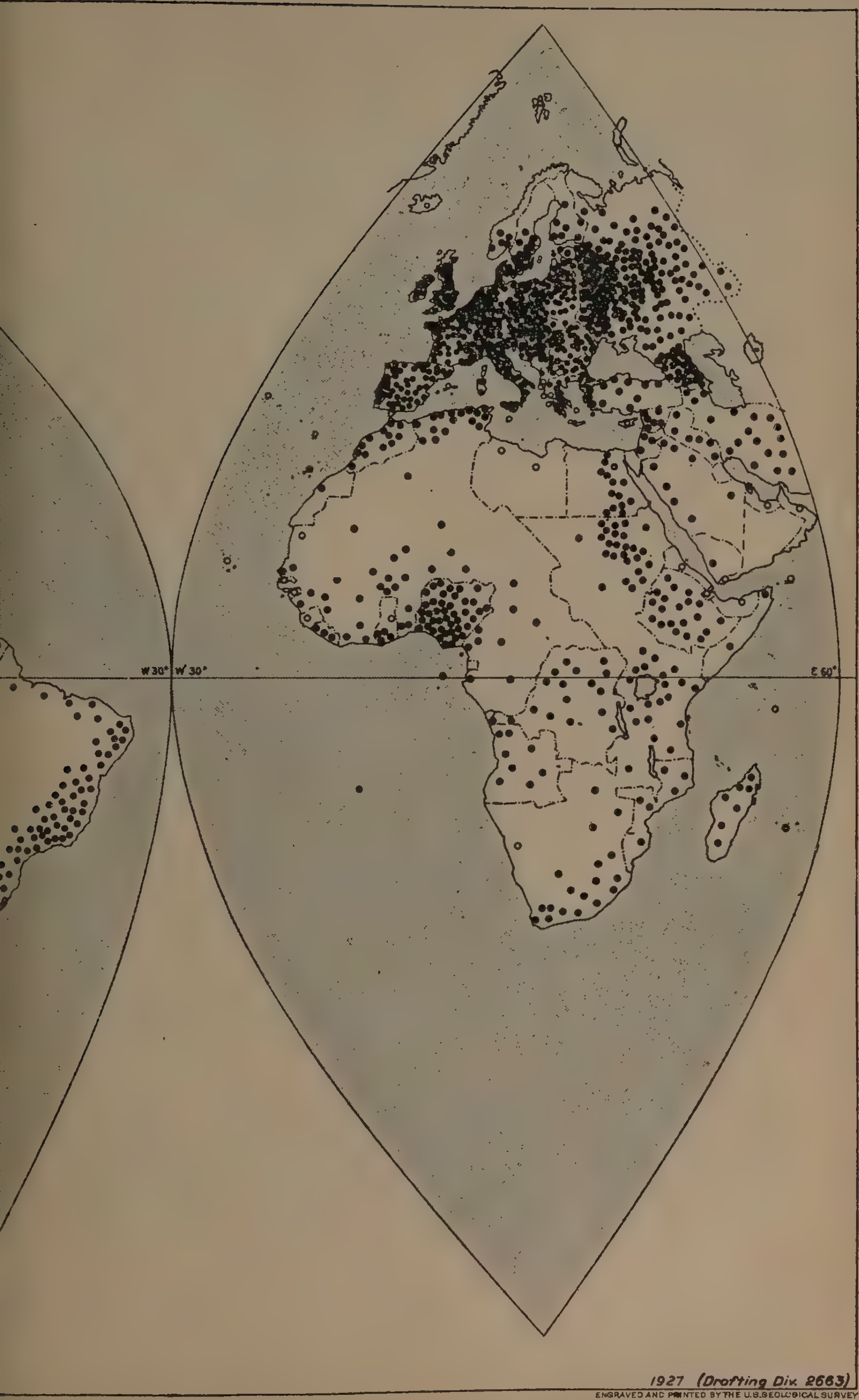

1927 (Drafting Div. 2663)

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These are only illustrations to show that man and his institutions may greatly modify original natural conditions. These are economic matters, and, no doubt, much can be said against a life which is dominated by economic values. Some persons will contend that an industrial society is materialistic, that spiritual things are neglected, and that even the moral timber of the people has been degraded under a régime of industrialism. This may, or may not, be true; but the fact remains that the economic values persist, and that the development of modern human institutions now takes place largely under the influence of these values. As long as these norms are uppermost certain human qualities are preëminent in the process of development. We may discuss some of these qualities briefly.

DESCRIPTION OF THE HUMAN RESOURCE

Health, strength, and endurance rank first among such properties. The capacity for work depends first of all on these things, and this is no less true of the ability to think. Imagination may be stimulated by an empty stomach, but this unfortunate condition is not conducive to the attainment of the things upon which imagination dwells.

The quality of health is not fundamental, nor is it peculiarly regional or racial. It is itself a compound of a number of variables.

> Health depends on inheritance, climate, food, clothing, shelter, occupation, mode of life, the virulence of bacteria and other parasites, the conditions of medical practice and sanitation, and various other factors. Every person is apparently born with the capacity to live a certain length of time provided there are no accidents such as disease. . . . Other things being equal, the person with health and energy is the most useful in business and in almost every other way. Not only can he accomplish more than the weak, sickly person, but his judgment is usually better.[1]

No doubt certain qualities of health seem to be racial, or at least to depend on regional conditions. Some races, for example, are better able to resist certain diseases than is the case with others. "The black race living in the tropics is relatively immune to all tropical fevers (which are so fatal to the whites) and to cancer. Immunity from the first of these scourges may have come about through natural selection covering many hundreds or thousands of years. Immunity from the second may have occurred in the same way, although in some races there seems to be an immunity against a disease with which, in their early history, they seldom or never came in contact. The white race, for instance, is more immune to sleeping sickness than are the blacks, although white people have seldom come in contact with it."[2]

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[1] Huntington and Williams, *Business Geography*, p. 66.

The black races are susceptible to respiratory diseases, such as tuberculosis and pneumonia, and to tetanus, sleeping sickness, and yaws. But they are relatively immune to fevers, cancer, and trachoma. The yellow race is susceptible to cholera, leprosy, plague, smallpox and trachoma; but is relatively immune to fevers and tropical disorders, and to sleeping sickness.

These immunities, however developed, are a great economic advantage to the races which possess them, because such peoples can labor under conditions where others fail. But it ought to be added that the white races which have developed the medical sciences have in some important instances come into possession of artificial immunity, for they have discovered serums to protect themselves against smallpox, typhoid fever, and some other diseases.

In this connection, there seems to be an adjustment of people to climatic conditions. To some extent this is found in the inhabitants of the southern and the northern parts of the United States. This adjustment is more pronounced among the people who live in the cold north, or in the extreme south. Capacity for work in high altitudes may have been developed by a kind of selection. At any rate, some of the natives in the high Andes can perform tasks which the rarefied air prohibits to those who have lived closer to sea level.

Another human resource of preëminent value is intelligence. As with health and physical stamina, this quality is not a racial, or even a regional, or national trait. The faculty of understanding, or of mental acuteness, or sagacity—however one wishes to define intelligence—is found among some people of every region of the earth; and, on the other hand, mental density, or dullness, coexists in precisely the same habitats. No doubt intelligence is to some extent a derived quality, depending partly on health, character of food, and on the nature of the environment, both physical and intellectual. Association of ideas has much to do with the mental growth of a people, but there must be something to associate. In a backward region, where life is static, there is little to stimulate thought, and to set the train of association into motion. But in a community where people have begun to become economically active, something new is presented to their thoughts and imaginations, and the process of association has something to act upon. New ideas are presented for thought and action; these subsequent ideas suggest others, and so on. There is a momentum of intellectual growth which increases in intensity as development takes place. It is a fair assumption that the inventiveness, resourcefulness, and business acumen which characterize the people of the United States and western Europe are the result of just this kind of momentum which arises through the association of ideas. This is notably the case with invention where one idea suggests another; the higher forms of technical management and of business finance are a development of a similar kind. A mentally stimulating environment is necessary to economic progress.

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[2] Loomis Havemeyer, *Anthropology*, p. 50.

We should include in our list of human resources the qualities of industry, perseverance, and self-reliance. And we may add again that no race has a monopoly of these qualities. Even in the United States there are thousands of occasional laborers who cannot grind themselves down to constant work. And, on the other hand, in the backward countries there are many people who are as alert and diligent as the circumstances under which they live will permit. In recent years we have forgotten that the American farmers were once characterized as lazy and indolent and that it was often necessary to defend them against this charge. In making his defense an Illinois editor about 1820 stated: "The farmer thinks it unnecessary to plant more grain than can be disposed of at home; thus part of his time passes in inactive languor; but once point to him a market where he may have a sure sale for his produce, and every nerve is exerted in the cause of industry."[3]

When people begin to live and work together in community life other important human characteristics become important. They include the willingness to coöperate, honesty, and reliability. Orderly business presupposes a high degree of honesty. Business practice becomes more or less standardized and traders are expected to obey the rules of the game. In fact, these relations crystallize into law, and there are contract arrangements which every civilized government recognizes. Such law enables business men to know in advance the conditions under which they must conduct their affairs, and to which all members of the community will be forced to conform. Without such arrangements economic relations would be in chaos.

What we have said above is not to be taken to mean that it is impossible to state the characteristics of a people in rather general terms. There are exceptions enough, but, at that, there are certain features which, for the time being at least, make fairly clear the manner in which these qualities function as present human resources. Custom, habit, tradition, religious beliefs and formalities, and even prejudices, sometimes give character to a people, although these conditions are not unchanging. In India, for example, the existence of the caste system constitutes a feature of the social conditions; but there is plenty of evidence to show that religious prejudices are breaking down and that social customs are changing under the influence of European ideas. A similar remark applies to the Spanish dominions which for centuries operated under the Ley de Indias, to the effect that "gentlemen must not mix with traders and sellers of merchandise." The old preference for an honorable position in government service is tending to disappear, and some of the younger generation are entering business pursuits, although the entrée seems to be by a side door, namely, through the professional occupations—engineering, law, etc.

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[3] I. Lippincott, *Economic Development of the United States,* 2nd ed., p. 168.

THE PEOPLES OF INDIA

With the qualifications we have just given we may now study the economic qualities of the people in some of the leading regions of the world. India presents an interesting case. Social conditions suggest a number of serious handicaps to present industrial progress. The existence of a great number of languages, which hampers ready intercourse, the interdictions of certain religions, and the existence of the caste system, operate in this way. There are some hundred and fifty languages spoken and written in India; to bring the Bible to even a portion of these people it has been necessary to translate this book into more than fifty languages.

Loosely speaking, India may be divided among three great races, namely, "the Hindus of northern India, who are in origin Caucasian; the Dravidians of South India, a dark race often resembling the Ethiopian more than the Caucasian; and a Mongolian fringe in the extreme northeast and along the foot of the Himalayas, which came largely from Thibet. Burma, lying outside the Indian peninsula toward the east, is naturally Mongolian, being closely related ethnologically to China. It belongs to India politically, but not from the point of view of race or physical geography."[4]

Hinduism predominates except in the northwest, where it shades off into the Mohammedanism of the countries farther west. But the latter religion is found to some extent in all parts of India. In certain districts of the south possibly one-third of the population is Mohammedan. Buddhism prevails mainly among the Mongolian population of Burma. The Parsis are a small religious group of Persian origin, but of great importance in India as merchants and financiers.

Religion is an important element in the lives of the people, and it exerts an influence on trade and industry. The Hindu religion regards the cow as a sacred animal. It is a sacrilege to kill this animal, and naturally a devout Hindu will not touch the meat, tallow, or hides. The mutiny of the Sepoys in 1857 was precipitated by the refusal of some of the native regiments to use cartridges which had been greased with tallow. As we have suggested above, the refusal of natives of different castes to work together imposes great difficulties in the organization of work where such castes may be required to labor under one roof. Indeed, it is one of the handicaps to the introduction of factory methods, and to the effective organization of industries.

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[4] *British India,* Special Consular Report No. 72, p. 34.

In this connection one of our government reports gave the following advice in regard to packing goods for sale in India: "It is often desirable also that articles which have not been touched by hand in their manufacture, and which are purely machine products, be labeled to that effect, as it is not permitted to some castes to even touch an object which has been touched by the foreigner or even one of lower caste."[5] The difficulties of marketing goods when such conditions prevail is obvious.

India is a country of great extremes of wealth and poverty. Purchasing power is by no means in proportion to the great population numbering some 318,000,000. The native princes and the nobles are extremely rich, but the great masses of the people are poor. In 1915, in many cases the earnings were less than $3.00 a month. Between two-thirds and nine-tenths of the population of this country are supported either directly or indirectly by agriculture. But methods of cultivation are in most cases primitive and inefficient and the standard of living is extremely low. This unfortunate condition is perpetuated through certain peculiarities of the land system. As in many other countries of the world the natives long for land ownership. But considering the enormous population there is not enough available land for distribution in effective farm units. While the country contains many large estates the native holdings range from two acres to one hundred. The system of dividing property among children upon the death of the parents leads to a further splitting of these areas until the individual holding is very small and is sometimes distributed in several parcels in different locations. Under this arrangement effective organization and management of farming industries is impossible. A further handicap to progress is widespread illiteracy, amounting to about 90 per cent of the total population. Under the conditions named above the human resource cannot function as effectively as in the United States or some of the western countries of Europe where the productivity per man both in industries and farming is relatively high, and where there is ample income both for consumption and saving.

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[5] *Ibid.*

CHINA

For many years both American and European merchants have been inspired by the latent possibilities of the Far Eastern markets. There is indeed in these countries an enormous potential market. China and India together contain more than one-third of the population of the world. But the low state of their industries, due partly to the peculiarities of custom and tradition, have prevented these countries from developing consumption in proportion to the latent possibilities of the population.

A feature which has characterized Chinese history since the time of Confucius (551 B.C.) has been conservatism, and even today this is a condition of Chinese life, and it explains much of the industrial backwardness of the country. There are several reasons for this attitude: first, the difficulty of acquiring a knowledge of the written character has tended to restrict education to a privileged class; second, the attitude of this class has been dominated by what might be called a spirit of classicism—the worship of the lore of the past. One result of this frame of mind has been the discouraging of the study of nature. This is a reason for the backwardness of the sciences, and whereas in progressive countries growth of science has formed the basis for the development of industry, this stimulus has been absent in China. Moreover, the prolonged influence of Confucianism has confirmed the conservative attitude in the minds of the Chinese people.

Nowhere in the world is there such great respect for ancestors.

> In some respects, the dead appear to receive more attention than the living. Ancestral tablets are kept in the household, and ceremonies are performed before them on days designated for that purpose. Ancestor worship is common throughout China. These ideas are inextricably interwoven with that remarkable institution, the Chinese family.

It is not uncommon for a Chinese to trace his ancestry back a thousand or more years. The seventy-fifth lineal descendent of Confucius lives today in Shantung on the Confucian estate, where the great sage was buried during the fifth century before the Christian era. Practically every Chinese has an ancestral home.[6]

Another interesting aspect of this attachment to the past has an important economic bearing.

Custom and tradition carried more weight than law. The lawyer was unknown in Chinese society prior to the beginning of the twentieth century. A man's relation to his fellow men was based on equity rather than upon legal definition. On the whole, society was very loosely knit, so far as its relations to the larger unit, the central government, was concerned. So long as China remained isolated, this condition of affairs might have continued. There was apparently no reason from within for a change, but the inevitable contact with the civilizations of other peoples altered the entire situation.

For example, the

ideas of corporate business, as taken from the West, cannot succeed in China without an accompanying sense of the responsibility of trusteeship. Potentially the Chinese possess the qualities necessary to the success of corporate enterprise, but before corporate business can be developed in a large way among the Chinese mercantile communities, it will be necessary to institute a body of laws and courts competent to build a solid foundation for the new order.[7]

Anyone who has studied the advantages of the corporate form in relation to business methods in progressive countries understands the magnitude of the disadvantages mentioned in this quotation. For one thing, the corporation makes possible the assembling of the savings of the people and the direction of these savings to industrial uses. Moreover, the corporate form enables a large number of people who invest their funds in enterprises to function as a unit. Under this form ten thousand people can own and operate a business as easily as five individuals, and in some cases much more effectively. Apparently, China is not yet ready for the introduction of this form of enterprise.

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[6] *China*, U. S. Department of Commerce, Trade Promotion Series, No. 38.
[7] *Ibid.*, p. 393.

Another retarding influence, which has operated through the centuries, is the lack of means of communication. Thus, there has been no powerful agency to break down the provincialism which is a characteristic of the country. In 1924 there were only 8,200 miles of railway to serve more than 440,000,000 people. In some of the most populous areas there are no roads, as we understand the term. There are no wheeled vehicles, except wheelbarrows, and the rickshaw serves for the transportation of passengers. This absence of adequate means of carrying freight is not only an enormous handicap to commerce, but it results in a great loss of human energy.

Further, the respect for the past has discouraged initiative, scientific research, and invention. As yet the country possesses no patent office. The same attitude has discouraged the development of the great physical resources which the country is said to contain. Industry is still in the cottage or hearthside stage. Among other things, the low economic status has militated against the spread of education; possibly more than 80 per cent of the people are illiterate.

As with India, agriculture is the chief occupation; but the country has been farmed for so many centuries that fertility must be restored to the soil, usually by laborious methods. In addition to other disadvantages, China suffers from the lack of adequate irrigation, and from poor knowledge of economical farm methods. Thus the native industry and thrift of the farmer is dissipated in a vast amount of needless work.

RUSSIA

This country contains one of the largest areas in the world under one jurisdiction—namely, 8,189,000 square miles; but the population is only 144,800,000, and thus the density is not great. Here, economic and political conditions have held the people back. A troublesome autocracy which expressed little or no interest in industrial matters, a system of land tenure, which in the process of development finally bound the peasant to the soil —a condition from which he was not freed until 1861—widespread illiteracy, lack of transportation within the country, and absence of adequate contact with the outside world, were some of the retarding factors. Even today Russia possesses only 46,000 miles of railroad. Because of the low state of industry, wealth has accumulated very slowly, and there has been only a relatively small amount for investment in business enterprises. Russia contains many important physical resources, and the people have a capacity for industry, but the system under which they labored thwarted the most economical use of the labor force. The change from the old order to the new, whatever the subsequent form may be, cannot be accomplished in a brief period. Thus the potential resources, both physical and human, will require some time for development. But this has been the case with every country which has attained to the highest stages.

AFRICA

The continent of Africa is the home of some of the most backward people of the world. Even today very little is known of some of the tribes of the interior, and, with a few notable exceptions, the physical resources are unexplored. Here and there an area has been touched by modern civilization. The Union of South Africa, for example, is a British dominion; with the introduction of outside enterprise it has become one of the largest producers in the world of gold and diamonds; and agriculture, and some of the minor industries, are prospering. The population is composed largely of natives, namely, 5,100,000 out of a total of 7,540,000. Europeans number about 854,000; in addition, the population contains some Asiatics and a mixture of people from the Far East and from other parts of Africa. The European population brought the enterprise, and thus South Africa is coming under the spell of modern methods of production.

Egypt is practically an independent country. Much of the remainder of Africa is parceled out among several of the great powers. France controls a large area in West Africa; Belgium is in possession of the Belgian Congo—a region of rich promise in the south-central portion of the continent. On the north coast Algeria and Tunis are French; Tripoli is controlled by Italy, and Morocco is largely under French influence. The powers also have scattered holdings of less importance in other portions of the continent.

Tropical Africa offers least prospect for development. A large portion is desert. The dreaded malaria is fatal to most Europeans. Much of this portion of the continent is inaccessible. The numerous villages have little to buy and sell, and at that, they can be reached only by trails or footpaths. Goods must be carried on the backs of animals, usually camels or oxen, but sometimes by human porters. Over large areas the cattle are pestered by the tsetse fly, the bite of which is usually fatal.

Practically all the European nations are active in the development of their respective possessions. This involves the investment of capital by both government and private enterprise. This usually takes the form of road and railway building, harbor improvements, and the working of farms and mines. Thus large portions of Africa are being developed by what might be called transplanted enterprise. The native influence in this work counts for little or nothing, except perhaps, as common labor, and as such it presents one of the serious problems of the continent. Not only is there a shortage of labor, but the native laborers lack incentive, and it is difficult to organize them under European methods and to teach them to use technical devices.

SOUTH AMERICA

In composition the people of South America present features not found in any other region of the earth. The blending of races is not unusual, for this has taken place practically everywhere. Through the ages, migration has been one of the great activities of humanity, and the result is that there are no pure races, and no qualities which can be said to distinguish one pure race from another.

Many parts of South America are still occupied by native Indians; where this condition prevails, life is of the most primitive kind, and such regions rank with vast areas in Africa as being among the most backward portions of the world. But this is not the case with the sections into which Europeans have penetrated.

It is the composition, and the results of the blending, that distinguish Latin Americans from other peoples. In a general way it might be said that the ingredients in this melting pot are Spanish—or Portuguese in the case of Brazil, Negro, and native Indian. But each of these components is by no means elementary. In the veins of the Spanish, for example, flows the blood of the Celts, Goths, Moors, Romans, and Semites, among others. This complex Spanish stock has been fused in various proportions, according to the region, with the other stocks named above. In addition, the large immigration of recent years, particularly to Argentine and south Brazil, has added other elements to this mixture. The Italians have been a large factor in this new immigration, but this movement has also included a large number of Germans, particularly in south Brazil, some French, English, and Russians; and on the west coast a considerable number of Chinese.

This condition may be summarized as follows:

> The distinguishing types of people inhabiting Latin America are the whites, more or less pure; the mestizos formed by the union of white and aboriginal; and the pure Indian; then follow the mulatto, formed by the union of white and black; and the zambo, from the union of Indian and black; and lastly the small fusions of miscellaneous peoples. The first three are those of national importance, but it is to the mestizo that the future of Latin America belongs; and it is this class which constitutes the Mexican, Brazilian, Peruvian, Chilean, or other specially designated people of the New World.[8]

The human aspects of these people have been described as follows:

> The better and normal side of the Latin American character reveals sound qualities which call for full recognition. There are certain elements in Latin American civilization which are superior to those of Anglo-America, as represented by the United States and Canada, and which may be of great value in molding the future of the American democracies. The strong ideals of art and oratory, and the pride of refinement and courtesy which are displayed, together with the refusal to be dominated by the too commercialistic spirit such as influences their northern neighbors, mark out the meridional inhabitants of the New World as a more imaginative and less material-minded people.[9]

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[8] C. R. Enock, *Republics of Central and South America*, p. 16.
[9] *Ibid.*, p. 21.

This does not mean that the Latin Americans are opposed to business enterprise as such; what they seem to resist is the dominance of the commercial spirit. There is much industrial enterprise in this part of the world pursued by the Latin Americans themselves. They have contributed largely to recent industrial development, particularly in Brazil, Argentine, and Chile, although they have been aided materially by both foreign enterprise and capital. The latter has been invested largely in railroad building, and through loans to governments in the improvement of ports and harbors, to some extent in plantations and in manufacturing plants, and in the west coast countries, in the development of various kinds of mineral deposits.

CHARACTER OF THE PEOPLE OF THE INDUSTRIAL NATIONS

We might include under this caption the United States and Canada, and the principal nations of western Europe. As we have already seen, these regions contribute a little less than half of the external commerce of the world. In this portion of the world the industrial and commercial spirit is most highly developed. In these regions, also, the human factor receives its greatest aid in technical improvements, and in a high quality of organization and management. Here is the original home of practically all the modern epoch-making inventions, and here, also, the momentum of invention and discovery carries business forward at a rapid pace. The population of these countries contains millions of trained workers of every description. Business methods are an object of study, and an important part of the schooling of the people has to do with industrial technique and management. Custom and tradition have not lost their force entirely, but they are not an important handicap. They have little or no influence in the policies of the great manufacturing enterprises of the United States, although, to some extent, they account for certain features in the business of western Europe. In all these countries consumers respond readily to changes of vogue and style. It is easy to persuade consumers to take new commodities. This means that it is easy to create new wants and to stimulate the productive effort designed to satisfy them.

A CHANGING WORLD

We have discussed the status of the human resource in the leading regions of the world. Other places of less importance will be considered in later pages. It is evident even from a cursory observation that economic and social conditions are in a process of change. It is patent, also, that even in the most backward sections this change is gaining momentum. We have looked upon China, for example, as a place where tradition has become crystallized, yet the old customs are breaking under modern pressure.

Everywhere traditions which relate to the position of women are the most static. In China the place of the woman is considered to be the home. According to social forms, she does not appear when a man is entertaining his friends, and she is not expected to be in public places, as in western countries where men and women gather for entertainment. When women go to the old-type theater they are seated in a section set aside for them. But this practice is changing. In Shanghai today many Chinese are adopting western social customs. "As Shanghai sets the standard for the rest of the country, it may be expected that western ideas will gain gradually in popularity, modifying certain old Chinese customs. In Peking and Shanghai some of the Chinese women have taken to dancing and to western forms of social entertainment." [10]

We may take another illustration from a part of the world where traditions have been regarded as steel bound, namely, Turkey. Here the "heavy veil of some years ago has given place to a much thinner one or has been discarded entirely. The Turkish woman is no longer the 'black phantom' described by Pierre Loti, but a very modern woman, conscious of her power and of her rights and eager to go forward toward full independence and opportunity of service." [11]

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[10] *China,* U. S. Department of Commerce, Trade Promotion Series No. 38, p. 39.

[11] *Turkey,* Commercial and Industrial Handbook (U. S. Department of Commerce), p. 31.

EFFECT OF MIGRATIONS

These are only a few cases. Examples could be multiplied from many parts of the world. What are the reasons for this change? The first answer is found in the mingling of people through the process of migration. From time immemorial migrations have been a great force in modifying habits and customs, and in bringing changes in social and economic systems. These shifts of people are usually prompted by some economic motive. When tribes were in the nomadic stage, conditions of food supply were often the impelling forces. While nations were forming, people often moved to escape robbery and oppression, and to seek places of refuge. In recent years the moving force has sometimes been bad economic or political conditions at home, or the prospect of improved livelihood in other parts of the world. In 1914 it was estimated that more than 10,000,000 crossed the national borders of the world in a single year. They were a tremendous force in modifying the conditions in the regions in which they settled.

We may take as an example the contributions of the immigrants into England after the sack of Antwerp in 1576. The newcomers were considered a great gain to the country. Flemish merchants became citizens of London. They employed their knowledge and experience in the advancement of English trade. They contributed to the growth of industry. Due to their influence new manufactures were founded, including the finer kinds of silks, damask, velvet, cambric, and tapestry. They brought the knowledge of paper-making, glass-working, the production of clocks and watches and of pottery. Moreover, they trained others in their crafts, and in time these industries became firmly established.

In a similar manner the flood of immigrants to the United States brought the knowledge of new trades and callings. Immigrants supplied vast quantities of skilled labor, to say nothing of much larger quantities of the unskilled variety. Their presence enabled managers of American industry to organize plants on a much more effective basis than would have been possible without them. To our misfortune they have sometimes brought alien ideals about political and social organization, and it has been necessary to guard against a too extensive infusion of thought of this kind. The British and Dutch immigrants into South Africa have converted a primitive society into one organized on a modern basis. The same is true of even the small European migrations to the East India islands. And the Italians in Argentine and Brazil have exerted a considerable influence upon the economic and social systems of these South American countries. The small number of Chinese students who have studied in American and European universities have been an important force in bringing western ideas to their home country.

EFFECT OF COMMERCE

In the equalization of differences among nations, and in breaking down peculiarities of customs and traditions, trade is even a more effective agency than migrations, for it is more penetrating and far reaching. Among regions which are in ready communication, style and vogue pass from one to another with great rapidity. This is notably the case with a country which is a recognized leader in certain respects, as, for example, French fashions. Certain producing centers have built up trade names of great international commercial value. This is the case with Doulton, Worcester, Sheffield, Valenciennes, Cambrai, and Zurich, to name only a few such places. English woolens are in demand throughout the world, and at one time Swiss watches attracted the fancy of purchasers in many countries. Even machinery plays a part in world commerce. American textile, boot and shoe, and wood-working machinery is exported to many parts of the world, in many instances coming into the hands of our potential competitors.

From the point of view of effectiveness of human labor, commerce plays a rôle of great importance. For one thing, it is a factor in the world division of labor by which peoples, or communities, devote attention to the things in which they have advantages in production, and exchange with the rest of the world. Such trade economizes labor force and is an important element in the economy of human effort throughout the world.

Commerce has always been a great spur to human activity by creating new wants and by stimulating the efforts on the part of workers and consumers to obtain the income to satisfy such desires. Trade frequently puts people into possession of commodities which they cannot produce themselves, or at least, which they cannot produce as cheaply as can be done elsewhere in the world. In this case commerce releases labor in the importing countries for more effective service.

Various other agencies promote the equalization of habits and customs, and lead to increased labor efficiency. Among such agencies are the spread of means of communication—railroads, good roads, the telegraph, telephone, and now the aëroplane. The wide diffusion of news service works to the same end, and the gradual development of education in many parts of the world contributes something to more effective methods of life and work. In recent years the investment of large sums in backward countries is one of the great agencies for increasing the effectiveness of labor by bringing in better tools and machines.

ECONOMIC SUSCEPTIBILITY

There is every reason to believe that all peoples, however backward, are moved by economic motives. This means that they are stirred to greater effort by the appearance of new wants, or by greater stimulation of the old. All people labor to satisfy personal wants and to satisfy the needs of their dependents. They are keyed to greater effort by desire for position and esteem, by longing for power, and by desire to secure means of protection against future accident or want. Rivalry, also, both in production and consumption plays its part. No doubt, individuals and people throughout the world differ greatly in all these respects but nevertheless they are not immune from the attack of economic motives. The effect of these motives in increasing the effectiveness of the human resource cannot be underestimated.

QUESTIONS

1. Give illustrations of the statement that the economic development of a people depends on (*a*) the character of the people; (*b*) the nature of the physical resources; (*c*) the kind of social institutions.

2. Why can a region with highly developed industries sustain a larger population than one which ranks lower in industrial progress?

3. Give illustrations of the manner in which original natural conditions are changed by man and his institutions.

4. State and estimate the relative importance of the various factors of which human resources are composed.

5. Do you think that some races are superior to others with respect to such factors as health, immunity from disease, climatic adaptability, possession of the value sense, etc.?

6. Is there such a thing as "momentum of intellectual growth which increases in intensity as development takes place"? If so, does this affect the economic development of a people?

7. Is a stimulating mental environment necessary to economic progress? What constitutes such an environment?

8. Explain why "willingness to coöperate, honesty, and reliability" are necessary conditions for economic progress.

9. Explain how custom, habit, and religious beliefs have affected the economic conditions of peoples.

10. Why has not China developed into higher industrial stages?

11. Account for the industrial backwardness of Russia.

12. Explain how "transplanted enterprise" has become an important factor in the development of backward regions.

13. Many parts of South America were settled before North America. Why has South America lagged behind the regions north of the Rio Grande in economic growth?

14. Are Latin American ideals higher than those of North America? What is the test of "higher ideals"?

15. Are commercial and industrial ideals of a lower order than the so-called cultural ideals?

16. Give illustrations of the effect of migrations on the social and industrial conditions of peoples.

17. Explain how commerce tends to change the habits, thoughts, and economic systems of nations and peoples.

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CHAPTER III

INSTITUTIONS

In a sense, the social forms which develop under the influence of custom and tradition are institutions. We learned in the preceding chapter that these have a material effect on the character of industries in a country. But there are other relations which are partly of spontaneous growth and partly the result of conscious effort on the part of the community. Some of these arrangements pertain to government and others to private business. At times these institutions have a decided influence on the growth of industries and on the development of resources.

GOVERNMENTAL INSTITUTIONS

All governments seek to mold political and economic institutions in accordance with certain ideals. In democratic countries these ideals usually stress the idea of freedom, particularly the freedom of individuals to develop in their own way, provided this is not contrary to the social welfare. During the earlier years in the United States it was assumed that individuals achieved more beneficial results for themselves and for their fellow men if left largely to their own initiative. In recent years this doctrine of *laissez faire* has been modified in important respects, because it is believed that unregulated freedom generates certain evils which are not self-curing, or at least which are not eliminated promptly. For this reason most modern governments take a hand in the process of development whether it is a matter of business or moral or political conditions. Whenever a matter is affected with the public interest a government may exercise its powers. But the manner and extent of intervention depends upon the interpretation which law-making bodies or courts place upon the concept of social welfare.

Governmental activities may be put into two classes, namely, promotive and regulative. In the first instance, it is assumed that there are certain things that ought to be done, but which will not be accomplished by private enterprise. Such activities include the improvement of rivers and harbors, reforestation, flood control, the collection and dissemination of general trade information, the improvement of roads, and the maintenance of public education. In this class, also, are tariffs, bounties, and concessions which are supposed to be in the public interest. Many nations of the world are trying to encourage the development of their resources and industries and they are willing to grant what amounts to financial aid to private persons, or companies, in addition to the more general work which the government itself undertakes.

TARIFFS

A promotive measure which is employed in one form or another by practically every government is the use of import duties. In many cases these imposts are devised partly for revenue, but the protective purpose is usually involved, and not infrequently it is the dominant motive. Tariff practice varies from country to country. As the student probably knows, the United States has existed continuously under the protective system since about 1862. While this tariff weighs heavily on some classes of goods, a surprisingly large percentage of imports—in value—is admitted free of duty, amounting to 64.4 per cent in 1926.

Some of the elements of the British Empire use a preferential tariff by means of which the dominions are given more favored treatment than other parts of the world. In Australia, in 1926, in addition to the preference given British goods, there was a further "sentimental preference" in the case of public purchases, sometimes amounting to 20 per cent. This policy imposed a considerable handicap on companies outside the Empire which made bids on public works and supplies.

The world's trade in raw materials is probably much freer than is the case with manufactured goods. Even the newer countries which have expectations for the development of industries try to promote such growth by means of tariffs. Thereby, they hope to invite the investment of foreign capital and, in some cases, to encourage immigration. Their purpose is also to diversify industries, to increase the demand for domestic materials, to improve the status of labor, and, in general, to promote the enrichment of the country. While much can be said against the protective tariff, it may be claimed, on the other hand, that the very general use of this device is a factor of importance in the development of local resources in many parts of the world.

A great diversity of conditions prevails in regard to tariff treatment of raw materials. Countries which are in the extractive stage devote their energies chiefly to production from forest, field, and mine. They do not fear competition from imported raw materials. Their chief concern is to develop a foreign market for their own materials, and for this reason import duties are not imposed. But with countries which at once produce raw materials and engage in manufacture, foreign competition may be of some concern for both classes of goods. In that case both kinds may be protected. The United States presents an interesting example. In the tariff of 1922 iron ore (including manganiferous ore), copper ore, unmanufactured copper plates, bars, ingots, and both anthracite and bituminous coal were admitted free of duty. On the other hand, such agricultural products as wheat, corn, and wool were subject to duty. Thus, in our case, some raw materials were taxed while others were exempted.

Tariffs often include samples brought in by salesmen, although it is the general practice to remit the duty when the traveler leaves the country, or to require him to make a declaration that the samples will be taken out. Some countries permit the free entry of certain machinery and supplies used in agriculture. As a matter of fact, our own tariff of 1922 exempted certain agricultural machinery from import duty. Countries which are eager to encourage immigration frequently permit the immigrant to bring in goods and supplies without duty.

EXPORT DUTIES

According to constitutional provision the United States is not permitted to impose export duties, but the use of such taxes is rather common throughout the world. The United Kingdom, Germany, the Netherlands, Denmark, Australia, among others, do not impose export duties. On the other hand, Argentine, Uruguay, most of the states of Brazil, China, Portugal, Bulgaria, and Roumania, not to include the whole list, make use of such duties. The motive varies from country to country. In some cases the export duty serves the purpose of discouraging foreign shipment when the materials are needed at home. This tax is used at times even by countries which do not produce local supplies, the purpose being to protect the industrial or national interest. Some countries apply the preference principle to exports also. Certain French, Portuguese, and Spanish colonies make a distinction in rates on goods exported to the mother country and on those destined for foreign consumption. Portuguese colonies carry this distinction a step further, and distinguish in their rates between commodities carried in Portuguese vessels and in those of other nations.

We may give a few examples. Italy levies export duties on iron ore (except pyrites), lead ore, and copper ore; Mexico places such duties on petroleum products; Peru, also, taxes petroleum and its derivatives; Spain taxes lead, copper, and manganese ores, among others; Bolivia taxes tin, silver, copper, zinc ores, and others. In some cases the tax is graded, depending on the selling price of the commodity. Such regulations range all the way from a mild system of control, which is of no great importance, to "those restrictions imposed by countries which are important, if not the principal, sources of given raw materials, and whose control of exportation by a restrictive system has a distinct international bearing in its effect upon the quantities available to other countries or upon prices."[1]

CONTROL OF RAW MATERIALS IN FOREIGN TRADE

For many centuries the nations have regulated their foreign trade, but modern methods are on such an extensive scale as to constitute this kind of regulation a unique feature of present international commerce. During the late war a number of nations developed an extensive system of control through a license system. The purposes were to prevent valuable materials from getting into the hands of the enemy, to conserve the supply of useful materials for use among the Allies, and in many instances to economize ocean shipping space. The nations have largely abandoned their war regulations, but another kind of control has been developed, usually under the benevolent eye of the interested governments, if not at times by their actual assistance.

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[1] *Export Duties of the World,* Foreign Tariff Series Bulletin No. 42, p. 2.

The great oversupply of certain products, like coffee and rubber, suggests regulation as a means of protecting the producers. If the McNary-Haugen bill had not been vetoed, wheat, corn, cotton, and tobacco would have been added to the list of controlled raw materials. Sometimes, as in the case of international pools and cartels, regulation is sought partly to obtain monopoly gain, and partly to equalize production and consumption. The political aim is also involved, as with petroleum. At one time or another, capitalists of some of the great nations have sought to extend their control over iron and coal, and some commodities of lesser importance, such as tungsten, nickel, and natural nitrates, and interested governments have not been averse to the expansion of this influence. Both for the purposes of national industrial expansion and for the further growth of political power, there can be no question that these systems are most effective devices. Before the War we used the term "economic penetration" to describe some of these methods.

We may take as our illustrations rubber and coffee. In both these cases the United States is particularly concerned because our people are the largest consumers in the world of both these commodities. The total number of registrations of motor vehicles in the United States in 1926 was more than 22,000,000, and with the enormous production of automobiles, rubber has become an article of necessary consumption, if not a key material.

THE CASE OF RUBBER

The total production of wild and plantation rubber in 1925 was about 515,000 long tons, and of this amount 381,800 long tons—or 74.1 per cent—were consumed in the United States. Some ten or fifteen years ago, if we may judge from the price, there was a handsome profit in producing this commodity, and a still greater profit was in prospect if production could be kept beneath the growing needs of consumption. This encouraging outlook greatly stimulated production. At any rate, the price of fine Para rubber in New York in 1910 was $1.908 a pound, and of ribbed smoked sheets, $2.066. In 1924 the price of the first kind had declined to 21.2 cents in New York, and of sheets to 26.2 cents. This great decline spelled loss for many producers and directed attention to methods of regulation.

Production since 1910 has expanded more than seven times, from 80,000 tons to about 620,000 tons estimated for 1926. In fact, the output has expanded even during the period of control. From 1922 to 1926 it gained more than 200,000 tons. In the first named year the British government came to the aid of producers with legislation based on what is known as the "Stevenson scheme," taking its name from the Secretary of State for the Colonies. According to the plan, prohibitive duties were to be imposed on rubber exported by estates in Malaya in excess of a fixed percentage of normal producing capacity. This ratio was to be changed from time to time, varying with the price. It was evident at the start that the scheme would encounter serious handicaps without the coöperation of the Dutch, but the Netherlands refused an invitation to join. However, British producers in Dutch colonies agreed voluntarily to restrict their output.

The original enactment became effective in 1923. Some of the important provisions were as follows: No person was permitted to export rubber without a license, or coupon, or other document, issued by the Controller of Rubber Export. The duty was based on a fixed scale. In case of holdings under twenty-five acres the exporter used a coupon and was taxed the minimum rate. Producers with an excess over twenty-five acres were put on a license basis. If they shipped no more than their allotment they paid the minimum duty. But if they exceeded a specified percentage of "standard production" they paid the duty on a sliding scale. The percentage for each quarter was based on the average price of rubber in the London market during the preceding quarter. The Assessment Committee decided what was the standard production of the estates.

According to the regulations in effect November 1, 1926, the operation was as follows:

> If the average price during any quarter be less than 1s. 9d. per lb., but not less than 1s. 3d., the percentage exportable at minimum duty for the ensuing quarter will be reduced by 10. But if the reduction be from a figure of 100%, the reduced percentage shall be 80. If the price be not less than 1s. 9d., but less than 2s., there will be no change. But if the average price be not less than 1s. 9d. in each of three consecutive quarters, the percentage for the ensuing quarter shall be increased by 10. If 2s. a lb. or over for any quarter, the percentage will be increased by 10. But if the increase be from 80% the increased percentage will be 100. Where the average price is below 1s. 3d., the percentage will be reduced to 60. Where it is over 3s., the percentage will be increased to 100. But all this with the proviso that in no case will the percentage ever exceed 100 or become less than 60.[2]

The expressed purpose of the Stevenson Act was to stabilize conditions between producers and consumers. The proponents of the plan realized that there was little hope of achieving this result by outright control of prices, and so they sought to regulate one of the factors upon which the price is based, namely, the supply. It was believed at the time the act was put into effect that the existing oversupply was only temporary, and that world consumption would soon overtake the capacity for production. Since the full production of Malaya and Ceylon was about 360,000 tons, the maximum curtailment, namely, 40 per cent, would have involved a reduction of only 140,000 tons, and it was believed that the growing demand would shortly absorb this excess, and that control would no longer be necessary. These estimates overlooked certain important factors which we shall discuss presently.

ALORIZATION OF COFFEE

For some years a similar condition of oversupply has existed in the case of Brazilian coffee, and here, also, efforts have been made to deal with the question of the surplus. Since Brazil exports, as a rule, nearly 70 per cent of the world total, control, at least for a time, seems to hold out some promise for success, provided local conditions can be regulated. Moreover, another encouraging feature is the limited number of planters.

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[2] *Europa*, 1928, p. 107.

The valorization policy was first adopted in Brazil about 1906. Some ten years prior to this date the agricultural products of São Paulo, the chief coffee state, had been somewhat diversified. But with the increase in profit in the production of coffee, planters largely abandoned the growing of corn, rice, beans, and other commodities as commercial crops and gave their attention to coffee. Overproduction was the result. The history of the attitude of the farmers of São Paulo during the five years after 1900 reads very much like chapters from the recent story of American farmers. Prices declined; farms were mortgaged; foreclosed property passed into the hands of bankers, and in some cases into foreign hands. In the midst of this depression planters demanded that the government restore prosperity. The outcome was the development of the valorization schemes.

As early as 1902, as a preliminary step, the state of São Paulo prohibited for several years the planting of new coffee trees. In 1906 the states of Minas Geraes, Rio de Janeiro and São Paulo entered into an agreement to provide for control overproduction and marketing. A loan of about $75,000,000 was made to carry out the plan. Subsequently, the two other states withdrew and São Paulo was left to carry the burden. From time to time the Brazilian government has granted financial support to various valorization plans. In 1921, for example, the federal government issued paper money, which, with the help of other loans, made possible the purchase of over 4,500,000 sacks of coffee. In 1922 the President was authorized to arrange for a Permanent Institute for the Protection of Coffee. Among other things, this organization was to provide for loans to growers on easy conditions, and for the guarantee of coffee deposited in official warehouses. Upon certain occasions large foreign loans were required to carry surplus crops. Such loans, of course, involved the intervention of the international banker and an administrative committee composed of representatives of government and bankers. When coffee was deposited as security for such loans the disposal of the product was in the hands of the committee.

As with the control of rubber, those who administered the valorization of coffee went behind the price to one of the factors upon which the price depended. In other words, they sought to control and allot the supply. Thus, according to an agreement signed by four Brazilian states in May, 1927, a fixed percentage of the coffee shipped from the ports of Santos, Rio de Janeiro, and Victoria was allotted to the coffee-producing states tributary to these ports, and each month as many bags of coffee were to be admitted to those ports as were exported the previous month.

The success of valorization is yet to be tested. There is no doubt that, with the exception of the brief period from 1907 to 1910 inclusive, the import price into the United States has been higher than before valorization was put into effect. In some years the average price has been very much above the 1906 level. But, of course, there is a great question about the cause. The United States is the largest consumer of coffee in the world; both our total and our per capita consumptions have increased greatly during this period. To give the figures, in 1906 this country imported 853,800,000 pounds, or 9.72 pounds per capita. In 1926 imports amounted to 1,495,500,000 pounds, or 12.4 pounds per capita. While it is true that European consumption declined in 1926 compared with 1914, the growth of the American demand more than offset the loss in Europe. Occasionally, frost and poor crops in Brazil have relieved the market of the surplus of previous years. Moreover, the producers of coffee in Central America, and in the northern parts of South America have not yet had time, since the rise of prices, to materially increase their crops. Because the coffee tree does not yield until the fifth year new production does not respond at once to rising prices. Valorization, therefore, has yet to meet non-Brazilian competition which may appear as a result of more favorable market conditions.

THE MCNARY-HAUGEN PLAN

Although, because of the President's veto, control of certain agricultural products was not put into effect in the United States, the so-called Surplus Control Bill deserves brief study because it is in the spirit with the world movement for control of great materials. As the American student knows, the demand for this measure arose because of the depression in some agricultural sections, and by reason of the desire for a more orderly system of marketing. Thus, the American farmer has this much in common with the rubber-planter and the Brazilian coffee-grower. But in details the American plan was different from British and Brazilian methods.

In the preamble of the bill Congress declared its policy to be the promotion of orderly marketing of agricultural products both in the United States and in foreign trade, the control and disposition of the surplus, and the prevention of undue depression of prices because of the periodic appearance of a surplus. In these respects the declared purpose of control was in agreement with the practice in regulating coffee and rubber.

The *deus ex machina* in the proposed organization was the Federal Farm Board to which was entrusted the general powers of policy and control. This board was to have been composed of the Secretary of the Treasury, ex officio, and twelve members, one each from the Federal Land Bank districts, appointed by the President in the usual manner. The board was specifically charged with the duty of collecting information about crop conditions, prospective supply and demand, and the possibilities of the appearance of a surplus in any of the controlled commodities. The act also provided for the appointment of advisory councils of seven members for each of the controlled commodities. These bodies were to be distinguished by the name of the commodity under their immediate supervision, as for example, the "Cotton Advisory Council." The councils were to advise with the board as to methods of control, and they were to study data gathered by such councils or submitted by the board.

Although the price feature was not stated in the bill it was expected that prices would be stabilized on a higher level than existed during the last four or five years under the régime of international competition. It was deemed necessary, also, to guard against overproduction. The much mooted equalization fee was expected to serve this purpose, and in addition, it was to defray the expenses of control. The framers of the bill were so insistent on this feature that they were willing to take their chances with a veto if the bill contained this provision.

The fee would have been most difficult to administer. It was to have been collected from each unit of the commodity at the most convenient point on the way to market. Thus the task might have fallen on any one of a number of processors—millers, packers, canners—or on the transportation companies, or even on the sellers directly. In any case, this signifies that the fee was to have been deducted from the selling price of the commodity. The act set aside $400,000,000 to be used as a kind of revolving fund. Of course, the Farm Board could not stabilize international prices, but it was hoped that it could maintain the American price and sell the surplus in foreign markets. This feature would have had a serious effect on wheat producers in European countries, to say nothing of the depressing influence on farmers in Argentine, Australia, and other places which market their wheat in Europe. Their international purchasing power would be diminished, including their capacity for purchase in the United States. No one could foretell the effect of such a measure on the intricate fabric of manufacture and trade in the United States, nor upon the commerce of other countries with America. Some countries, no doubt, would have been forced to readjust their tariff policies to meet the new situation.

RESULTS OF SYSTEMS OF CONTROL

One obvious effect of this system of control, whether applied to rubber, coffee, wheat, or to any other commodity, is to add one more element of risk to manufacturing consumers in importing countries. Regulation puts them more or less at the mercy of the control bodies. American coffee merchants have complained bitterly both of the secrecy and the uncertainty involved in the regulation of their commodity. An open market is easier to forecast than a controlled market. American tire manufacturers have suffered great losses because of the vacillating methods of the British council.

The feeding of the supply into the market is always subject to the policy, and sometimes to the whims, of the control body.

When the purpose of regulation is to advance the price the ultimate consumer bears the burden. Moreover, control retards the natural process of weeding out inefficient products and postpones the diffusion among consumers of production and marketing economies. In fact, it is a device for depriving consumers of the benefits of progress. Further, the different parts of the world, or even adjacent regions, which produce any given commodity are not on the same cost basis. Some have decided advantages over others. In some cases the cost is high, in others low, with a wide range in between. While the elevated price brings temporary benefit to the high-cost producer, it confers a still greater advantage on the producer whose cost is low. In any event, it is a great stimulant to further production, and it thus aggravates the problem which it is designed to solve. Even the export tax feature, or the equalization fee, to name the American device, does not equalize production conditions because it is not assessed according to the relative advantages among producers as to cost. Finally, it would be difficult to justify an export tax, or an equalization fee, which took away from the low-cost producer the benefits of his condition, particularly when his low cost is obtained by efficient methods of production.

When materials enter international trade there is an added disadvantage of control because the regulating bodies, if authorized by the laws of the home government, have no jurisdiction beyond national borders. Thus a country which employs such methods will sooner or later encounter reprisals in the form of tariffs, or discriminations of some other kind, against its commerce. Possibly this is one reason for the development of the international cartel.

CARTELS

A cartel, at least in European countries, is usually a loosely knit organization in which the participating companies retain their identity. The combined organization makes agreements with respect to prices; or production, that is, supply; or markets, which means regions or spheres of interest which the combined companies agree to control. Except for the features upon which they agree the participating units manage their affairs independently. Cartels may exist wholly within national borders, but in many cases they are international in scope. Sometimes they are concerned chiefly with manufactured products; at other times, with raw materials. But their essential feature is control over some element of the marketing process.

Professor Robert Liefmann describes five kinds of structures:

(*a*) The purely regional cartel. In this type of organization each separate territory is reserved as a market for the products of the firms in that territory.

(*b*) The regional cartel with agreements concerning marketing in other countries. These agreements may relate to any element of control, such as price, supply, and division of the market.

(*c*) The mutual agreement regulating prices without the intervention of regional cartels.

(*d*) The agreement to limit output. In the case of international cartels, this form is not usually employed, due to the difficulties of allotment among members and of control over foreign production.

(*e*) The syndicate. Such agreements are based on the sharing of orders and profits and the control of the entire market for certain kinds of commodities.

Professor Liefmann refers to a large number of cartels which existed before 1896. For example, twenty-two of these arrangements were formed between German and English producers; thirteen between Germans and Austrians; ten between Germans and Belgians; and nine between Germans and French. But this list is incomplete.

In the appended table we give a list of some of the more recent combinations.

Commodity	*Countries Involved*
Aluminum	France, Germany, Great Britain, Switzerland, and portion of the industry in Norway and Austria. Formed, 1926.
Artificial silk	Great Britain, Germany, Italy, and the combination includes certain plants controlled by German and British interests in the United States. Formed, 1927.
Copper	United States, Spain, Belgium, Jugoslavia, and Great Britain. Formed, 1926.

Commodity	*Countries Involved*
Electric bulbs	Germany, United States, Canada, the Netherlands, France, Italy, and Scandinavian countries, Great Britain, Austria. Formed, 1924.
Enamel ware	Germany, Poland, Czechoslovakia, and Austria. Formed, 1926.
Raw steel	France, Germany, Belgium. Formed, 1926.
Tubes	Germany, France, Luxemburg, Great Britain, Austria, Czechoslovakia, Poland. Formed, 1926.
Wire	Germany, Belgium, Czechoslovakia, and the Netherlands. Formed, 1927.

It is evident, therefore, from what has been said above that the cartel development is not a matter of the past ten or fifteen years; nevertheless, new factors have come into the movement. In the first place, in practically all the industrial countries, the capacity for production has been increasing more rapidly than the demand. The postwar readjustments, including the decline in many places of per capita consuming power, aggravated this situation. As a result, competition is much keener than in former years. Moreover, the more recent growth of mergers and amalgamations has paved the way for cartel agreements by concentrating large amounts of capital in the hands of some large producers; and finally, political conditions have had an influence. In some respects, postwar tariffs have made it more difficult for one country to market its goods in another. The international cartel is one method of escape from some of the burdens of high duties.

Some ten or fifteen years ago the international cartel was regarded both by people and governments with apprehension, and for good reason. In some respects this form of organization has even greater monopoly power than combinations within national borders. For one thing, the arrangements are more extensive and they are usually secret. Moreover, the agreements are beyond the control of any particular nation, even where such governments have enacted antitrust laws.

Since the close of the late War the international cartel seems to be growing in favor for both political and economic reasons.

These organizations are regarded as one of the means for coping with some of the unfortunate results of the War, and of minimizing the maladjustments within individual states, if not in the industrial world as a whole.

In this connection Professor Liefmann states:

> Various leaders of industry—in different countries—have often recommended international cartels as instruments for overcoming the difficulties of the present economic situation throughout the world. The Cartel section of the German National Union of Industry has frequently discussed this question and set up a sub-committee to deal with it. The International Chamber of Commerce in Paris has put the problem of international cartels on their agenda. A close investigation and supervision of international cartels is certainly desirable, and may best be carried out on an international basis. During the session of the Inter-Parliamentary Union in October, 1925, the Norwegian representative, Jon Sundby, moved that international cartels and trusts should be dealt with by that Union, and that a permanent commission be appointed for the purpose.[3]

THE AMERICAN TRUST

Combination experience in the United States has led more and more away from the loose, or federated, form of organization to the amalgamation and merger, in which the various units are consolidated under one control. Thus we have passed through the stages of pool, legal trust, holding company, to complete consolidation. Although for commercial and manufacturing purposes the legal trust has about disappeared the name is still retained to designate the large organizations which are supposed to possess monopoly power. In many of the great fields of industry, such as steel, copper, automobiles and chemicals, there is at least one great company which has largely integrated related industries and which produces an appreciable portion of the total output of that industry.

In America competition is always active, but there are some meliorating conditions which are not largely operative in Europe. For one thing, the industrial and financial power of the large companies is much greater than in Europe. In many cases these companies are strongly fortified with liquid assets, often in the form of cash and securities, which serve as a cushion when times are hard. Moreover, the income of many of these companies is derived from diversified activities—and from income on investments—and this is also a benefit when times are bad. But a factor of utmost importance is not only the resiliency of the American market, but its enormous proportions; and this market is still growing at a very rapid rate. Further, the activities of the trade associations in one way or another soften some of the rigors of competition. And finally, if bad comes to worse, combination of weaker with stronger companies is sometimes a way of escaping bankruptcy, and often of paving the way for future profits. All in all, competition works in quite a different way in this country as compared with Europe.

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[3] R. Liefmann, *Cartels, Combines and Trusts,* p. 36.

In international trade and industry many American companies pursue a kind of financial penetration—that is, acquiring interest in foreign organizations. To use the words of Professor Liefmann: "American capitalism seems to attach more importance to attaining adequate shares in the various British world monopolies and their profits than to beating them."[4] But another way of gaining a profit out of foreign trading is investment in plants and trading facilities abroad. There are a considerable number of completely owned foreign subsidiaries of American companies. In fact, this is one way of stepping over tariff barriers. But the foreign subsidiaries also promote trade with the home country, as we shall see in a later chapter. The huge American investment in mining and other properties abroad is a foreign trade factor of no mean importance.

AMERICAN COMBINATIONS IN FOREIGN TRADE

We referred above to the growing interest of European governments in the cartel movement. The United States has also provided a legal means for American combinations to enter the foreign field. Such provisions are contained in the Export Trade Act of 1918. One important reason for the enactment of this

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[4] *Ibid.,* p. 92.

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measure was to make possible some form of association which could both compete in foreign markets with foreign combinations, and combine for selling American commodities to European combinations. In one respect this act was a defensive measure, for one purpose was to enable American associations to deal with similar combinations abroad. But the proponents of the measure also looked forward to an aggressive foreign trade policy. The law makes legal a combination which is organized for the sole purpose of export trade; but such associations must not become a party to an agreement, or conspiracy, to raise or lower prices within the United States, or to restrain competition in this country. Moreover, the act legalizes the acquisition of one company of a part, or even the whole of the stock of other companies if the purpose is to engage solely in foreign trade. The administration of the provisions of the law are in the hands of the Federal Trade Commission.

EFFECT OF COMBINATIONS ON THE DEVELOPMENT OF RESOURCES AND INDUSTRY

Anyone who has observed the operation of American combinations knows the effect on industrial development. Some of the policies of these organizations are open to criticism, but this much is true—they are great engines of efficiency. They spare no money in eliminating waste, in improving methods of production, and in making technical and organization changes which reduce costs and make possible the expansion of sales.

Such organizations possess all the advantages which economists attribute to big business, such as increased efficiency arising from technical division of labor, the development of by-product industries which convert waste into valuable commodities, the employment of skill in every division, and the employment of industrial research in the solution of the problems of business. A large business which carries its enterprise into the foreign field for the development of markets and resources brings its facilities to other countries and in this manner contributes to the development of their resources and trade.

But it should be added that in some cases combinations, whether domestic or international, are not much more than a shield for inefficient production. Such combinations enable the weaker members of the industry to exist because they are spared some of the depressing effects of competition, and because the combination itself removes somewhat the fear of rivalry. Some business is allotted even to the weaker members, and while they may make little or no profit, they are paid in expectation, and they remain as a burden to industry and to consumers. In some cases the great purpose of combination is monopoly gain.

According to the report of the world economic conference, held at Geneva in May, 1927, combinations must be considered as "good or bad according to the spirit which rules the constitution and the operation of the agreements, and in particular, according to the measure in which those directing them are actuated by a sense of the general interest." [5] The members of the conference were of the opinion that if such combinations were able to secure a more methodical organization of production and a reduction of cost, and if they acted as a check upon uneconomic competition, a great deal could be said in their favor. But, on the other hand, if they engaged in monopolistic practices they were a check upon technical progress, and as such they were a menace.

QUESTIONS

1. Does "unregulated freedom" in business matters create evils which do not cure themselves?
2. What can be said for and against the *laissez faire* doctrine in business?
3. What tests would you apply in determining when an industry is "affected with a public interest"?
4. Are tariff duties an effective method of building up home industries?
5. Explain the term "preferential tariff." How does it work?
6. Does protection promote the investment of foreign capital in the protected country? Why?
7. Do protective tariffs tend to promote the development of the resources of the protected country? Why?
8. Why do some countries levy export duties?
9. How may the "preferential principle" be applied to export duties?

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[5] *Commerce Reports,* April 30, 1928, p. 262.

10. What is meant by the term "economic penetration"? Is the economic position of a country endangered when it is penetrated by the capitalists, or industrialists, of another country? Why?

11. Discuss the rubber restriction scheme. What do you think of it?

12. Is it possible to stabilize—for any length of time—the production of such raw materials as rubber, coffee, and wheat? Why?

13. What methods have been employed in recent years to solve the problem of overproduction of certain great raw materials? What do you think of these methods?

14. Is it possible, for any length of time, to stabilize the prices of materials on a higher basis than would be established in a free, competitive market? Why?

15. Name and discuss the economic results of systems for controlling surpluses.

16. Explain the operation of international cartels. Account for their development.

17. Is there a difference between the American trust and the European cartel?

18. Why do not American producers enter international agreements as readily as those in Europe? Have we other ways of accomplishing the same purpose? Explain.

19. In what ways do combinations affect the development of world resources?

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CHAPTER IV

RELATION OF FOREIGN INVESTMENTS TO DEVELOPMENT OF RESOURCES

On several occasions we have referred to the relation of foreign investments to the development of resources and trade. The enormous growth of the demand for raw materials, which must now be obtained from all parts of the world, has made this form of investment not only necessary, but at some times very profitable. The investments of the nations are the means for supplying the industrial portions of the world with great volumes of foodstuffs, with many essential metals, with rubber, petroleum, timbers of many kinds, precious metals and stones, and textile fibers, to mention only a few of the important commodities which enter world commerce. Investments also supply many facilities for trade without which the opening of new resources would be impossible. In this class belong railroad building, the operation of ocean shipping, the building of ports and harbors, to say nothing of financial and merchandising facilities, such as branch and agency banks, stores, and warehouses.

The funds for foreign investments are supplied by only a few countries and the chief trade benefits accrue to these same nations. This financial aid is supplied largely by private capital, but the nations which are now engaged in the industrial promotion of their dominions obtain large sums for this work by borrowing or by taxation.

NEED FOR FOREIGN INVESTMENTS

Private capitalists are, of course, in quest of profits. This is one motive for the export of capital. But there are more fundamental reasons. The higher rate of return in foreign investments is due in part to the growing needs for the materials which the outer world supplies and in many instances to the more prolific nature of foreign resources. Another underlying reason is the need for an outlet for the surplus of domestic savings. With several of the great nations—and the United States is the best example—savings are now accumulating more rapidly than satisfactory means of investment. Hence some of the new capital seeks the outer world. During the years from 1920 to 1927 the foreign issues of the United States ranged from 10 to 18 per cent of the total, and in the United Kingdom during the same period from 16 to 60 per cent. In other words, for one reason or another, some investors find the foreign field more satisfactory than the home country.

We should consider the cause of investment also from the point of view of those who receive the new funds. The poorer, or more backward, parts of the earth are often rich in industrial resources which for various reasons they are unable to develop. They are held back because of lack of proper machinery, or lack of transportation, or even by the absence of liquid funds. Investments of European capital in rubber plantations in the Malay Peninsula are estimated at more than $325,000,000. The natives themselves could not supply this sum. Development, therefore, depends on outside financial aid. Countries, like Argentine, which possess rich agricultural lands, or like the west coast countries of South America, or the French Congo, or South Africa, which are rich in mineral deposits, are helpless without investments from foreign sources.

Nor is this the whole case. In many instances the people who reside in a given area are not aware of the resources which their land contains. Work of experienced geologists and of mining engineers is required to make the discoveries and to estimate the industrial possibilities. Backward people do not even know the commercial uses of their natural products. This knowledge must be brought to them. For example, for years the Indians of Missouri were not aware of the uses of lead. Not until Frenchmen brought firearms did the Indians learn that the lead resources could be put to some industrial purpose. Thus the development of the newer parts of the world requires not only foreign capital, but foreign skill and enterprise.

USES OF INVESTMENTS

During the later years of the recent War, when American interests were trying to consolidate their commercial gains in Latin America it was frequently urged that the United States could not maintain its trade without the investment of capital. The implications of this statement were not true, partly because the merchants of this country had already built up a large trade before the War, and partly because there was a growing need for certain of our products which could not have been supplied satisfactorily from other sources. Yet, in general, there is truth in the statement that trade follows the investment. Then what is the relation between commercial expansion and the export of capital?

At first thought one might say that the extension of credit to importing merchants is a form of investment and that this credit must be given if the foreign merchant continues to buy. As a matter of fact, when the exporter actually carries the burden of credit he employs capital to expand his trade. This is, indeed, a form of foreign lending. Possibly this is what the South American merchants meant when they urged North American merchants to seek commerce by the route of investment. A large amount of the capital of the trading countries is involved in goods in transit, and on the shelves of distant consumers.

But the use of commercial capital is not the only form of foreign lending. Investment which lays a permanent basis for trade takes the form of development of resources. We may suggest two ways in which this is done. First, funds may be put into facilities for trade, such as branch banks and agencies, warehouses, repair shops, and the building of factories, and more particularly in the opening of means of communication, including railroads, improved port facilities, and telegraph lines. Such provisions must be made if commerce is to expand beyond the primitive stage.

A second way in which investment lays a permanent foundation for trade is in the actual exploitation of resources. In some areas the development of the soil resources has been an important source of trade. But the private investor frequently seeks profit from mineral and timber lands and from water power. Investments, therefore, may be classified as to their uses into expenditures for commercial facilities, and outlay for development of natural products. Government borrowing is usually for the first purpose, although the nations sometimes have other uses for borrowed sums.

MEANS OF COMMUNICATION

Transportation of some kind must precede the actual work of exploiting natural resources. This fact has been recognized by all commercial nations. If private capital will not venture, the burden of railway building falls upon the governments. No doubt, in some cases, government ownership has become an established policy, and this is one reason why the lines are not built and operated by private enterprise. But it is true, nevertheless, that in many instances the promise of an income from railway ownership and operation is not sufficient to encourage private capital to construct the lines. Government investment is therefore necessary. But the conditions of ownership and operation are by no means uniform from country to country. Some private mileage exists in practically all countries. In some cases governments own the properties, but lease the operation to private companies. And in some instances the lines are owned and operated by private enterprise but the government guarantees the companies' bonds.

A large percentage of the mileage of all South American countries is government owned. In Brazil, for example, in 1925, about 11,150 miles belonged to the federal government, about 4,570 were owned and operated by the various states, and 3,290 miles were owned by private companies. Most of the mileage of Argentine is privately owned. It was constructed originally by British capital and it is now largely controlled by British owners. But in 1925 the government of Argentine owned and operated about 4,300 miles. Most of this mileage, however, was for the purpose of promoting the development of some of the newer parts of the country. In 1925 more than 36 per cent (1,977 miles) of the railways of Chile were privately owned. The roads were built by foreign capital to gain access to the rich nitrate and copper deposits of the country.

In the Union of South Africa in 1925 only 500 miles of the total of about 12,500 miles were owned and operated by private capital; and in Australia less than 1,000 miles of the total of about 25,000 miles were owned and operated by private enterprise. It is evident from the statements given above that even where foreign lending is to governments, the proceeds of the loans are often invested in the development of commercial facilities. This condition applies also to telephone and telegraph service. In many cases such properties are owned by governments and the lines were constructed with borrowed funds. With all kinds of communication the service is usually provided far in advance of actual needs. But the purpose is to employ such facilities as an encouragement to development.

INVESTMENTS IN RESOURCES

The investor has followed closely on the heels of the explorer in practically every part of the world. This was the case with the trading companies several centuries ago. The history of the fur traders as exemplified by the Hudson's Bay Company is a little more recent illustration. The discovery of a great resource of any kind is the signal for the movement of capital. The great gold rushes of modern times are other obvious illustrations of this fact. At present, the great rivalry among American, British, and Dutch companies for control of petroleum is hardly less spectacular. But in a much quieter way the business enterprise of the great nations is in quest of baser metals, of opportunities for exploiting the products of forest, soil, and waters. For years, British and German capitalists have engaged in producing natural nitrates in Chile. American and British capitalists are developing the copper resources of Chile. In one way or another the same interests are involved in exploiting deposits of tin, bismuth, and gold in Bolivia. In South Africa, gold and diamonds are being produced by British enterprise; the rubber plantations of Malaya are worked largely by British and Dutch companies. American producers are interested in iron ore deposits in Chile and Cuba, in manganese in Brazil, in petroleum, copper, silver in Mexico, in the production of fruit in several Central American countries, and in sugar plantations in Cuba and Porto Rico, and in the production of pineapples in Hawaii. These are only a few illustrations but they serve as examples of the uses to which some of the surplus capital of the investing countries is put. In many cases the investment is not in resources but in manufactures. The American meat-packers, for example, have invested many millions of dollars in packing plants in Argentine, Brazil, and Uruguay. In some regions capital is also invested in public utilities, in urban real estate, in agricultural lands, in merchandising, and in banking.

We may take Cuba as an illustration of the scope of such investments. The amount of American capital in Cuba in 1925 was estimated at $1,360,000,000 which was about 85 per cent of the total foreign investment in the island. The distribution of this amount is shown in the following table: [1]

AMERICAN INVESTMENTS IN CUBA, 1925

Nature of the Investment	*Amount*
Sugar properties	$ 750,000,000
Government bonds	110,000,000
Railroads	110,000,000
Public utilities	100,000,000
Real estate	80,000,000
Tobacco and cigars	50,000,000
Factories	40,000,000
Mining	35,000,000
Merchandise	30,000,000
Agricultural lands	25,000,000
Banking	20,000,000
Ports, warehouses, etc.	10,000,000
TOTAL	$1,360,000,000

FOREIGN INVESTMENTS IN THE OLDER COUNTRIES

During the earlier years of its industrial growth the United States received from Europe large sums for investment. Great Britain was the largest contributor. From about 1820 to 1836 the borrowed sums were invested chiefly in public improvements, such as turnpikes and canals, and to some extent in bank stock. With the beginning of the railroad era foreign investors bought largely of these securities; they also loaned large sums to states which at that time were embarking on great railway enterprises. In the course of years, European investments in the United States have become greatly diversified. In addition to public securities, they included investments in the stocks and bonds of railroads, in ranching and farming, and in mining and manufacturing properties.

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[1] *Barron's*, July 5, 1926.

As late as 1914, when the War came, several billions of dollars of European capital still remained in this country. Estimates of foreign investments are always imperfect because it is impossible to locate all the sources of loans and to identify their transfer from one country to another. With this in mind the following quotation will give some idea of the status of European investments in the United States at about the outbreak of the War: "The American Dollar Securities Committee of London estimates that it sold back to the United States about £285,000,000 worth of American securities, and that at least another £100,000,000 went back to New York through private channels, making roughly a total of £400,000,000 of American bonds and stocks repurchased by investors in the United States."[2] But this was only a part of the total. In addition, large amounts of French, German, and Belgian capital were invested in this country.

In the earlier years of our development foreign investment served its customary function of enabling business enterprise to build railroads, and to develop mines, ranches, and plantations. In later years this added capital was an important contribution in building up the large companies. At all times these investments gave momentum to our industrial growth. It would have been impossible for this country to expand as rapidly as it did without the financial aid given by foreigners, particularly to railroad-building, because transportation systems in the United States, as in every other part of the world, were the imperative need of a growing country.

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[2] C. T. Hallinan, *American Investments in Europe*, p. 12.

While foreign capital is still coming across the Atlantic, the stream has largely turned in the other direction since 1920. and now the American surplus is seeking an outlet in Europe and in many other parts of the world.

It is natural that Canada, which is separated from us only by a political boundary, should be a large recipient of American capital. Moreover, this country is relatively new and needs outside financial assistance for the development of its many resources. In recent years investments from the United States have been on such a large scale as to lend some weight to the expression, "the American invasion of Canada." The largest single item is investment in national and municipal bonds amounting in 1924 to over $700,000,000. In one way or another a large proportion of this sum is employed for developmental purposes. In addition, over a billion dollars of American capital were invested in Canadian railway, forest, mining, and fisheries industries. Public service and other industries claimed about $600,000,000; and there were considerable investments in land, banking, and insurance enterprises. In 1927 the total foreign investments in Canada were estimated at $5,238,000,000. The rapidity with which American capital has sought this country is shown by the fact that our total investments in 1913 were only $417,100,000, while in 1927 the sum was $2,888,000,000.[3]

Because of geographical propinquity the migration of capital from the United States to Canada is often for the purpose of establishing factories, or the operation of mercantile undertakings. In 1924 "there were in Canada 680 branches of American enterprises. These represent a capital investment of about $400,000,000. They employ about 87,000 persons, and they paid annually in wages about $95,000,000. The value of the production of these factories was about $600,000,000 per annum. Since the total number of manufacturing establishments in Canada at that was about 43,000 and the total capital about $3,500,000,000 the percentage of the total capital provided by the enterprises of the United States was about 11.5 per cent."[4]

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[3] *Commerce Reports,* June 4, 1928, p. 571.
[4] *Barron's,* Aug. 9. 1926.

AMERICAN INVESTMENTS IN EUROPE

With respect to Europe, the United States was a debtor nation before the War. But, at that, comparatively small sums crossed the Atlantic from America. In 1913 the total American investment in European countries did not exceed $350,000,000. Postwar conditions have changed the whole aspect of American financial relations. In addition to the war debts having a face value of some $12,000,000,000, this country has loaned large sums for both corporate and governmental purposes. Borrowing for the account of various grades of governments has of course been a large item, but private corporations have also been very large borrowers. In the latter case, American capital has been invested in banking enterprises; iron and steel industries; hydroelectric power plants; land-credit institutions; the manufacture of chemicals; textile industries; steamship, telephone, and railway stock; to mention only a few classes of investment.

With reference to Germany, in many cases investment took the form of stock ownership rather than loans, although large sums were loaned to certain industrial companies. In 1925 the list included loans to August Thyssen Iron and Steel Works, German General Electric Company, Hamburg-American Line, Rhine-Main-Danube Corporation, and the United Industrial Corporation, among various others. In 1928 large sums were loaned to Westphalia United Electric Power Corporation, the German Building and Land Bank, Rhine-Ruhr Water Service Union, Gelsenkirchen Mining Corporation, to Vesten Electric Railway Corporation, and others. During the last five years large loans have been made to various industrial enterprises in Belgium, France, Italy, Denmark, Poland, Czechoslovakia, Finland, Norway, and Sweden.

In addition to the loans which are publicly offered, large amounts of American capital are being invested in foreign countries through private agencies, including the direct purchase of securities, outright purchase of properties, and the establishment of American branch factories. Such investments sometimes take the form of export of machinery and supplies, or the transfer of ownership through the intricate mesh of corporate finance, and in many instances it is impossible to identify the proprietorship and to trace the means of transfer.

These loans and investments signify that American capital is now contributing to a large extent in the upbuilding of certain European industries. The effect is to enliven enterprise, to stimulate trade, and to promote the further development of European resources.

This international flow of funds includes, also, much intercountry lending for both public and corporate purposes. The financial relations of the cartels, which we discussed in the last chapter, frequently involve investments of this description. While France, the Netherlands, Norway, and Sweden have been borrowers, their capitalists have also been lenders and investors in other European countries. During the years from 1924 to 1927 inclusive, at least five countries made considerable long-term loans to Germany. The total long-term loans to this country during these years were estimated at 4,250,000,000 marks (par value). The United States was the largest lender, contributing about 69 per cent of this total, but England contributed about 9 per cent, the Netherlands about 13 per cent, and Switzerland about 4 per cent.

In the Orient, Japan is beginning to use her surplus funds for investment in other Far Eastern countries. But, as with many other nations, Japan is both a borrower and a lender. In fact, in 1928, the debts and investments abroad just about balanced. At this time the total foreign investments amounted to about two billion yen. More than 75 per cent of this amount was invested in China, and included both loans to Chinese national and provincial governments and investment in private enterprises. On the other hand, foreign investments in Japan amounted to a little more than two billion yen and included holdings of government and municipal bonds, and corporate stocks and bonds owned by foreigners.

AMERICAN INVESTMENTS IN LATIN AMERICA

It is not surprising that North American enterprise should take the leading part in the development of the industrial opportunities of Latin America. The richness of the resources is an inviting factor. Some of these natural products, such as copper, are like those which American companies are exploiting on a large scale in the United States, except that in some cases the Latin American sources are more prolific than those of the United States. With their engineering skill and experience the American companies enjoy a great advantage in operations in Latin America. That some of these products compete with our own is a factor of importance, since ownership and development give the North American organizations the benefit of combined control. Moreover, Latin America produces many articles of which the United States is the largest consumer, such as sugar and fruits, and it is therefore profitable for American capital to engage in these enterprises. Since much of Latin America is in the tropics many products supplement those of the United States. There is therefore advantage to this part of the world for American enterprise both to produce and to market these products. As another cause, we should not overlook the large amounts of American surplus capital which are seeking the most profitable outlet. The relative nearness of these areas to the markets of the United States, and the political security which prevails in most of these countries are factors of some importance. In view of these various conditions it is not surprising that Latin America should receive so much attention from the business enterprises of the United States.

Cuba and Mexico were the first countries to the south to receive large amounts of American capital. The leading activities in the latter country have been the development of petroleum resources, and the production of silver, copper, lead, and zinc, although Americans have a considerable financial interest in other enterprises. The rise of the Mexican petroleum industry, particularly since 1913, has been the result of the investment of large amounts of American capital. In the case of Cuba, the establishment of an orderly government after the Spanish American War was the occasion for a rapid increase in investments in the island. Funds were employed in sugar and tobacco enterprises, in mining, in public utilities, and to some extent in manufacturing. And, of course, the Cuban government has been a large borrower.

Until about fifteen years ago Argentine, Chile, and Brazil were largely neglected by American capitalists, but within the last decade the stream of North American funds has been flowing strongly to all these countries until at the present time this section ranks second only to Cuba and Mexico in American financial esteem. Until about 1908, when Americans began to take an interest in Chile, our total investment was probably less than $25,000,000; but since that date an interest has been built up rapidly in mining properties, banks, railroads, steamship lines, and to some extent, in manufacturing plants. The total investment in 1926 was estimated at about $360,000,000. The amount in Argentine in 1924 was estimated in a compilation by our Department of Commerce at $312,000,000, of which $100,000,000 covered investments in other than government securities.

An illustration of the manner in which American enterprise operates in manufacturing and merchandising in Chile may be obtained from the following statement:

> American capital has been slow to enter the manufacturing industries, whereas a large part of the capital credited to continental Europeans is represented by this type of investment. Nevertheless, certain factories have been established by American companies, notable among which are the assembling plant of the Ford Motor Car Company, the Caupolican textile mills of Grace and Company, the sugar refinery of the same concern, the filling plant of the West India Oil Company, and the explosive plant at El Loa in which American capital has an equal share with British. The combined investments in these plants and in their distributing agencies will reach the sum of approximately $6,000,000.[5]

In merchandising, American companies were represented by such organizations as W. R. Grace and Company and Wessel, Duval and Company, two large trading houses which had been in the market for many years, and both of which had extensive investments in properties and stock. The Singer Sewing Machine Company, the United States Steel Products Company, the United States Rubber Export Company, the United Shoe Machinery Corporation, the American Locomotive Sales Corporation, the American Smelting and Refining Company, and the Aluminum

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[5] *Investments in Latin America*, III, "Chile," p. 7.

Company of America, among others, maintained branch offices in Chile for the purpose of marketing their products.

British investors were also active in Chile. In 1924 the total holdings amounted to £61,567,000. This sum was involved in national and municipal loans; in railways, banks, commercial and manufacturing enterprises; in land; in the supply of telephone, telegraph, gas, and water service; in mining; and in the production of nitrates. But the British and Americans were not the only investors. Considerable sums were supplied by the French, Spanish, Italian, Norwegian, Dutch, and Belgian investors, and some Argentine capital was also invested in Chile. A similar condition prevailed in regard to investments in other South American countries.

American loans to Latin American governments have increased rapidly since 1921. During the seven years from that date to 1927 the total public offerings in this country of Latin American issues amounted to $1,425,879,000.[6] Argentine has been one of the largest borrowers, but Brazil, Chile, Colombia, and Peru have also received large sums. In the case of the Central American countries, both loans and investments have been relatively small, compared with the other sections of Latin America referred to above.

AMERICAN AND BRITISH FOREIGN INVESTMENTS COMPARED

At best, statements of the foreign investments of the countries are only estimates. These statements are based on various data, some of which can be obtained with a fair degree of accuracy, and the others are largely guesswork. Some of the items which enter into these computations are public offerings of securities, values of stocks and bonds listed on the exchanges, interest and dividend payments of foreign governments and companies which pass through the hands of home bankers. Obviously, these items do not cover large sums which fail to make their appearance in any of these ways. When the estimates are based on payments of interest and dividends they assume a rate of return which may, or may not, be true; moreover, such computations are inaccurate because of the practice of many companies of reinvesting a portion of their income, and because of other financial manipulations. All estimates, therefore, must be taken *cum grano salis*. Although such figures may miss the mark, they supply the only available data concerning the extent of foreign borrowing and lending.

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[6] *Commerce Reports,* Jan. 9, 1928, p. 65.

With regard to Britain, the Board of Trade estimated the total net income from overseas investments in 1926 at £270,000,000. If this sum represents a 5 per cent return, the total investment amounted to about £5,400,000,000. In the case of the United States: "There are no official estimates in Washington as there are in Whitehall, and we must turn to private conjecture. Dr. Max Winkler, Vice-President of Moody's Investors' Service of New York and London, places the American total at the end of the year 1926 at $13,000,000,000 or £2,600,000,000. *The Wall Street Journal* suggests $12,250,000,000 or £2,450,000,000. This figure does not include the various war debt settlements. If they be added at their present value, $3,500,000,000, the total would reach $15,750,000,000 or £3,150,000,000."[7]

A recent tabulation of our Department of Commerce places the "net nominal capital" involved in foreign securities publicly offered in the United States during the years from 1914 to 1927 inclusive as $10,087,000,000. This, of course, does not include the war loans by the United States government to various governments in Europe.[8] In recent years, the foreign lending of the United States has greatly exceeded that of the United Kingdom. An accurate comparison of the figures is impossible because the British figures are based on prices of issue while the American data are based on par values. With this in mind the adjoining table presents a comparison of the foreign lendings of the two countries from 1920 to 1927 inclusive.

This table shows that the total foreign capital issues of these two countries for the eight years ending with 1927 amounted to nearly eleven billion dollars. Prior to the War France was one of the largest lenders in the world. It was claimed at that time that

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[7] Hallinan, *op. cit.*, p. 10.

[8] *Commerce Reports*, Aug. 16, 1928, p. 133.

FOREIGN CAPITAL ISSUES OFFERED IN THE UNITED STATES AND IN THE UNITED KINGDOM

Year	United States	United Kingdom
1920	$ 585,000,000	$218,000,000
1921	631,000,000	445,000,000
1922	682,000,000	599,000,000
1923	414,000,000	622,000,000
1924	928,000,000	593,000,000
1925	1,085,000,000	424,000,000
1926	1,135,000,000	546,000,000
1927	1,376,000,000	674,000,000

the Paris Bourse "controlled the credit of forty countries." While this overstates the case, it is true nevertheless that a considerable number of countries looked to France for financial assistance. Paris was one of the leading markets for loans to Russia, Spain, Portugal, Greece, Turkey, Roumania, Serbia, Algeria, and Tunis. In addition, the French people held large amounts of South American issues. From the statements given above we may conclude that the United States, the United Kingdom, and France were great reservoirs of credit. From these sources funds flowed to all parts of the world to promote either directly or indirectly the exploitation of resources and the development of trade. The United States has performed this function chiefly for the western hemisphere, but it has recently become a large lender to various European countries.

CONTROL OF FOREIGN LOANS

The lending of private capital abroad may affect national policy. For this reason, governments often make known their wishes to the international bankers. At times, private lending may embarrass the home government, as was the case a few years ago, when certain French bankers made loans to Turkey much to the discomfiture of Russia. As a rule, nations which are ambitious to expand their trade and build up political power look with favor on foreign loans, since lending builds up commerce, and develops distant resources. The home country expects to receive benefits from such activities. If the relations between borrowers and lenders work out according to expectations the government of the lending country is not called upon to use its offices in extracting payment from unwilling debtors. But it does not always turn out this way. Debtors sometimes delay payment of interest and principal. Occasionally, they repudiate their obligations. And sometimes, as with a few of the turbulent nations, a little revolution now and then threatens the orderly payment of debts, or results in the destruction of property to which creditors may have a legitimate claim. Under such conditions they call upon their government for protection.

In recent years another reason has arisen to give governments concern about foreign lending. It has become possible to use such loans in ways which work to the detriment of industries and consumers in the lending country. We have referred to the attempts to control certain important raw materials. The Stevenson rubber scheme, British control of tin and of Egyptian long staple cotton, the Franco-German potash monopoly, the state-owned Coffee Institute of Brazil, the Dutch control of quinine, and the Chilean control of natural nitrates and iodine are illustrations of this idea. Large amounts of capital are required to make such control effective, and funds for this purpose are often sought in the international money markets. With a plethora of credit the United States has become the natural haven for borrowers of every description, including those who seek world monopoly.

In this connection, Mr. Hoover recently argued that American consumers were being exploited by foreign monopolies which were either state-owned, or which enjoyed special protection from the state. He especially "attacked (and prevented) a proposed loan to the Franco-German potash combine, and he also attacked a loan to the Brazilian government to be secured on the revenue of the 'Coffee Institute.' Here he was less successful; the coffee loan was merely postponed until 1926, when it was successfully floated to the extent of $60,000,000—the largest loan Brazil ever secured from New York."[9]

The huge loans of the nations are now calling attention to new principles which as yet have not been clearly formulated, but which in time will crystallize into rules to guide the international bankers. It has been suggested that one of these principles should be the accomplishment of "certain results believed to be to the economic or financial advantage of the American people." Of course, the difficulty comes with the practical application of the rule; but the modern uses of international funds, and the trouble which sometimes arises from international lending, suggest that some principles should be kept in mind.

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[9] Hallinan, *op. cit.*, p. 41.

FOREIGN CONCESSIONS

The grant of concessions is closely related to foreign lending. In fact, many investments are made on the basis of concessions. A grant of this kind gives to private companies certain rights to explore for resources, or to develop certain kinds of industries. By this method foreign companies obtain an entrée into a region to carry on some business activity. Thus, concessions may relate to the exploitation of forest or mineral resources, to the working of plantations, the development of water power or transportation, and even to the importation of labor and the development of industries.

As a rule, the people of the country which grants the concession are not able themselves to carry on these activities and the grant is made with the expectation of a benefit of some kind, usually in the form of an income or royalty. In short, a concession is a means by which the poorer countries hope to have their resources and industries developed, and meanwhile to receive some immediate financial consideration.

The American companies which have been active in Mexico are familiar with this process, because much American capital which entered that country operates under a concession. Venezuela is now making similar grants to foreign companies which are exploring for petroleum. In fact, practically every Latin American country has granted concessions for the exploitation of some resource. Not long ago, Paraguay made a grant to an English engineering firm for the building of port and harbor works at Asunción. By the terms of the contract the company was to construct the works and was permitted to collect certain duties; part of this income was retained by the company, and the balance was to be turned over to the Paraguayan government. The duration of the contract was 99 years. But under certain conditions the government was permitted to terminate the arrangement in 37 years; if the company failed to discharge its obligations, the government reserved the right to take over the enterprise upon the payment of the amount already invested, plus 6½ per cent compound interest.

In a similar way, the government of Venezuela granted a concession to the National River Navigation Company which permitted this organization to engage in the coastwise navigation of the country, to explore for natural resources, to bring in colonists, maintain steamboat service on the upper Orinoco, establish cattle ranches, and to do a great many other things that held out a promise of profits. In return, the company agreed to pay 100,000 bolivars a year during the first five years, 125,000 bolivars during the second five years, and 1,000,000 bolivars a year thereafter.

Much of the petroleum development of the Near East is under the concession system. This is also the case with the plantation rubber industry, and for that matter, with the natural rubber industry in Amazonia. The development of the Congo copper deposits is the result of a concession granted to the Union Minière du Haut Katanga. Since the revolution, Russia has held out most alluring concessions to British, American, and German capitalists for the purpose of attracting capital. These are only a few illustrations of the method which is very general over the world.

A concession, like a debt, sometimes turns out to be a source of trouble. The competition among the capitalists of the great nations often leads to bitter rivalries in which governments become involved. The recent conflict over petroleum in the Near East is an example. Nor is this the only basis of trouble. Countries which offer concessions are sometimes not aware of the value of the grants; at a later time they may regret the bargain and try to escape their part of the contract. Moreover, at some later date, if the business prospers, they begin to fear the growing power of the concessionaire and seek to curtail the original grant. If there are great profits in working foreign resources there are also great risks both for companies, and for governments that make the grants. Nevertheless, concessions are a most useful method of distributing new capital over the world, and of securing widespread development of resources.

EFFECT OF FOREIGN INVESTMENTS ON COMMERCE

Foreign investment is not only a great aid to the opening of new resources, but it supplies an enormous stimulus to commerce. The nations which borrowed from the United States during the War spent practically all the borrowed sums in this country for food, iron, and steel, ammunition, and supplies of many kinds. Even when foreign governments borrow for the purpose of making public improvements the proceeds of the loans are often spent in the lending country. In fact, it is sometimes stipulated in the loan that the funds must be spent in whole or in part in the country of the lender. Thus, the process of foreign investment is intimately related to exporting.

That lending leads to the development of export business is most obvious in the case of the building of railways in new countries, or the opening of mines and the building of manufactures. The new country is not able to produce the machines, tools, and supplies needed to make the improvements. Thus, it becomes necessary to export railway iron of all descriptions, cars, locomotives, and supplies. The proceeds of the investment are spent in the country which makes the loan, and the railway equipment is exported. The same process is involved in the development of mines and the establishment of factories, for these enterprises, also, require tools and machines which are not produced in the country whose resources are being exploited.

On the other hand, investment leads to the growth of exports from the country which is being developed. In the first place, interest must be paid on the investment, and eventually the principal must be liquidated or transferred elsewhere. This signifies that payments in some form must be made from the borrowing country. Fortunately, investments usually produce their own means of payment. If the funds are put into railroads, the result is to bring new areas into contact with foreign markets and to encourage development. If the investment is made in mines and plantations the result is new products for export. Investment, therefore, is not only a means of developing new resources, but it is an agency of great importance in the expansion of commerce.

QUESTIONS

1. Explain how foreign investments promote the development of foreign resources.
2. What industries or resources usually attract the foreign investors?
3. Why do not the capitalists, or savers, of a nation invest their funds at home rather than abroad?
4. Do you think that investment capital is increasing more rapidly in the United States than satisfactory sources of investment?
5. If this is the case, does it mean that conditions of "overproduction" are rapidly creeping into our leading industries?
6. What benefits do the poorer, or more backward, countries receive from foreign investments?
7. What is the relation between the commercial expansion of a country and the export of capital?
8. "Investments may be classified into expenditures for commercial facilities and into outlays for the development of resources and industries." Explain and give examples.
9. Explain how foreign investments in railway-building in new countries promote the development of their resources and trade.
10. Why do not the people of Argentine and Brazil accumulate the capital for railroad-building and the development of enterprises in their countries?
11. What is the nature of American investments in (*a*) Canada; (*b*) Europe; (*c*) Latin America?
12. Explain how foreign investment promotes the development of the export and the import trade of the investing country.
13. Why are the United States, the United Kingdom, and France the chief lending countries?
14. For what reasons do governments sometimes seek to control the foreign lending of domestic bankers and capitalists?
15. What is meant by the term "dollar diplomacy"? What can be said for and against this policy?
16. Is it possible for borrowing nations to use borrowed funds to the disadvantage of industries and consumers in the lending countries? Explain fully.
17. Explain the operation of "foreign concessions."

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CHAPTER V

ECONOMIC ORGANIZATION

We have discussed hitherto certain factors in the development of the resources of the world, such as the distribution of the sources of raw materials, the influence of the human element in production, and the effect of foreign investments. It is clear from what has been said that the world is not divided into innumerable self-sustaining political and economic units. In fact, most of the divisions of the earth are in very close economic relation, and the growth of modern industry and commerce is establishing even closer bonds of economic contact. Even among primitive people, the tribes had some relation with the people in near-by territories. If no other reason, the quest for food brought them together occasionally. The dependence of one group on another, therefore, is a very ancient phenomenon. But today the economic relations of the regions of the earth are so extensive that interdependence is a world-wide experience.

NATURE OF ECONOMIC ORGANIZATION

Chance does not decide that tin from the Straits Settlements or Bolivia shall reach certain tin plate manufacturers in the United States, or that diamonds from Kimberley shall be sold to a particular jeweler in New York City, or that long-staple cotton from Egypt shall be delivered to certain spinners in the United States and England. These products flow to their destined markets with a regularity and certainty that sometimes amazes even the student of marketing. Vanadium from Peru; chromite from Portuguese Africa and French Oceania; monazite from Brazil, British India, and Canada; and shellac from India, Siam, and Indo-China move to consumers through established tracts. The members of the trade in each of these commodities can mark these channels and indicate the important points along the line of travel.

There are great central markets for some staples, such as wheat, cotton, and wool, and all persons who buy and sell know the routes taken by these commodities, and when and where contact can be made. These raw materials flow over established routes from points of production, however distant, to points of consumption. Somewhere on the way these staples may converge on an exchange, or in an auction market, to which all traders have access in one way or another. These markets are often connected by telegraph with similar markets elsewhere and buyers and sellers may know promptly the prevailing conditions.

Even where goods are not sold by the exchange method the routes are definitely known, and anyone who buys or sells can make the connections. A prospective buyer could learn in a short time where to obtain automatic stokers, plow points, or mine ventilator fans although he has never made a similar purchase before. In a similar way produce exchanges, mail-order houses, and department stores are concentration points for buyers on the one hand, and for sellers on the other. Such organizations, therefore, face in two directions: first to producers who have something to sell, in which case one of the important functions of the store is to assemble goods from a number of producers; second, to buyers who take the goods off the market.

WHAT IS AN ORGANIZATION?

The system by means of which goods move from distant producers over predetermined routes to consumers is called the market organization. As a matter of fact, there are organized markets in all the important branches of trade. But because these trades are more or less dependent on each other, and because all trades together are dependent on general marketing facilities, such as credit institutions, systems of communication, and arrangements for insuring and storing goods on the way to ultimate consumers, the market organization is at least nation-wide, and in some important respects it is world-wide.

Anyone who has observed the ease and rapidity with which an issue of the city of Dresden moves into the hands of some saver in San Francisco, or with which a government security issued by Turkey is delivered to a distant purchaser in some French town can understand at least that there is some organized device in the international world for establishing these contacts, although he cannot trace the route over which the security travels, or name the various middlemen who were responsible for its purchase and sale. What then is an organization, and what are its elements or factors?

By way of answer we may make two observations: First, an organization of whatever description is composed of parts; and second, these parts function together with more or less harmony to accomplish the purpose for which the organization exists. The market organization came into existence for the purpose of assembling commodities from many producers and delivering these goods into the hands of consumers. The essential function is to bring hundreds of thousands of producers into contact with millions of consumers. If the commodity is wheat, the various parts of the organization are farmers, brokers, commission men, exchanges, millers, bakers, candy-makers, to say nothing of the men who supply the various facilities required to move the commodity from one step in the transaction to another. If the commodity is produce of some kind, the elements in the market are growers, commission men, or possibly coöperative organizations, an auction market or an exchange, wholesalers, retailers, and household consumers. Or if the commodity follows some of the by-channels of distribution, the chain store, the peddler, the hotel, and the restaurant may intervene before the article reaches the final consumer. All these factors are linked together in the organization, and each plays its part. But whatever the process, the ultimate purpose is to make prompt contact between those who buy and sell.

RELATION OF ORGANIZATION TO THE DEVELOPMENT OF WORLD RESOURCES

The highly developed markets of today are the result of centuries of evolution. Fortunately, producers even in remote parts of the world find a very effective market machinery already in existence. In most cases the uses of the commodity which they are to produce are already established, and the market organization is at their service. If the commodity is new, as was the case a few years ago with kauri gum, or as far as the western hemisphere was concerned, with the soybean, the industrial world is already equipped with methods of bringing the article to the attention of consumers. In the case of manufacturers, this is one of the tasks of industrial research. The merchant employs advertising and salesmanship for this purpose. Thus, a company which exploits new resources is not required to wait until wants appear, or until an organization has been built up to handle his commodity. Developed market machinery is therefore a great asset to those who are engaged in opening foreign resources. In fact, this is one of the explanations for the rapid growth of the raw-product industries in many parts of the world.

This does not mean that market methods are fixed and immutable. In a progressive society the economic organization is never static. New elements make their appearance, as with direct selling from factory to consumer, and the mail-order business. But these elements are only alterations of, or additions to, the existing market institutions. Occasionally, a new producer must add facilities for production and sale. But these, also, are only modifications of those which already exist.

CHARACTERISTICS OF HUMAN WANTS

The ultimate purpose of the economic organization is to satisfy human wants. Current textbooks in economics tell us that any particular want can be satisfied in a given consumption period, but that wants in the aggregate cannot be satisfied. This does not tell the whole story, because neither producers nor consumers are passive. The latter are on the alert for new commodities which may serve their needs better than the present array of articles. Manufacturing consumers are, also, in constant quest of materials which make possible better and cheaper production. Many producers seek to diversify their output, and this means a more diversified demand. Moreover, merchants and manufacturers do not wait for consumers' wants to arise spontaneously. Their method is to create new desires through such effective agencies as advertising and salesmanship, and every consumer knows that these arts have been highly developed. The outcome of this enormous diversification of human desires is a similar diversification of business enterprises.

It would not be correct to say that varied wants are the cause of varied industries, because, as we have just said, the method of today is for producers to create wants. Thereby they increase their sales. Wants, and the industries which supply them, are in constant interaction. But this much is true—that both wants and industries are expanding with amazing rapidity.

Every new invention not only adds a new industry, and a new want, but it sets into operation a new series of demands which add momentum to the process of diversification. The coming of the automobile not only gave a new commodity and created wants for the new device, but it also created among final consumers new wants for the things which people seem to think are associated with automobile riding and companionship. Manufactures of these vehicles are affected in a similar way. The demands of the new industry were the cause for the appearance of a number of specialized enterprises, such as the manufacture of tires, bodies, wheels; repair shops; and others which took their places as associated industries. And the metal demands expanded to include new uses for iron and steel, tungsten, molybdenum, nickel, and vanadium, among others, to be used in highly specialized products. The rubber-planter, of course, found a new use for his product, and the manufacturers of timber, leather, and cotton fabrics found other diversified demands for their commodities. A new manufacture brings in a new constellation of industries and thereby the economic organization is expanded and developed.

These changes impose a greater tax on natural products and make necessary the exploitation of a wider range of resources. It has been claimed that more than thirty different regions of the world now supply various kinds of material for the manufacture of automobiles. Thus, each new invention of importance not only adds its peculiar set of related industries and wants, but increases the number of elements in the economic organization.

VARIED INDUSTRIES

Materials used in manufacture must often meet very exact specifications, depending on the use. If one studied the carbon content of some thirty different products of wrought iron and steel one would find that the percentage composition of this element is different in every case. Minute variations often give some property which meets a specialized requirement. The statement to the effect that the uses of ordinary common steel depend on the carbon, the process of manufacture, and the kind of treatment is, of course, very general, because there are dozens of different processes of manufacture and a similar number of treatments in producing the great variety of steel products on the present market. Hardness, elasticity, ductility, malleability, electric conductivity, and magnetic permeability are only a few of the properties.

Some idea of the exact demands of the iron and steel trade may be obtained from the following statement:

> The harder the material to be cut the more carbon will be put in the steel—compare stone-cutting tools with steel-cutting saws and carpenters' tools. But where hardness must be combined with resistance to shock, or some other service demanding at least a modicum of ductility, the permissible amount of carbon must be reduced. This requirement is exemplified in drills and chisels used for rock cutting by blows, and in saws (band and circular) which must be bent around in a circle. Between these extremes of carbon content are found the steels which require ductility to a greater or less extent. The service demanded of structural steel which is exposed to shock does not permit the addition of more than 0.25 to 0.30 per cent of carbon, but where the structural steel is in the form of wire that is used in twisted cable, as much carbon can be added as will permit the steel to be drawn cold through a die, and thus secure the maximum possible tensile strength. Bars to be embedded in concrete, known as concrete reënforcement bars, can contain as much carbon as will permit them to endure the requisite cold twisting and bending; cold-rolled steel must have enough toughness to endure deformation in the cold; machinery steel and many parts of machines and shafting can afford to sacrifice some ductility for strength.[1]

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[1] Stoughton and Butts, *Engineering Metallurgy*, p. 171.

This is only one illustration of the more or less exacting requirements of modern industry. Similar statements will apply to the manufactures of any of the metallic elements and of all of the alloys. In our discussions of wants we are accustomed to direct attention only to household consumers, but it is evident from what has just been said that in some instances the demands of the manufacturers are as varied and as highly specialized as are the demands of those who take from the market finished consumable goods.

One would say on first thought that the most important industries of any country are those which supply food, clothing, and shelter, for such manufactures provide what are called absolute necessities. Although this is not the case in all countries, since some are large importers of food, etc., it is substantially the case with the United States. According to the Census of 1919 the value of the manufacture of food and kindred products amounted to over $10,000,000,000 and of textiles and their products to a little more than $9,000,000,000. These were the most important groups of industries, judged from the point of view of value produced.

A most important feature of the manufactures of a modern industrial nation is the high rank of those industries which supply machines and tools. In the United States, in 1919, the value of manufactured machinery, exclusive of transportation equipment, was about $5,000,000,000, and the manufacture of such equipment was also valued at about $5,000,000,000. Our Census divided the manufactures of the country into sixteen comprehensive groups. The relative importance of these groups, measured by the value of the products, is shown in the table on page 91.

This table by no means conveys a correct idea of the extent of diversification of American manufactures, much less of its manufactured products. The foundry products, one of the subgroups, comprehended about 648 enumerated articles, but in this connection the Census report added that: "Notwithstanding the great variety of articles named, the list is only partial and many products of importance do not appear at all, simply because they were not specifically mentioned on the schedule."

THE VALUE OF PRODUCTS BY GROUPS
UNITED STATES, 1925

Group	*Value of Product*
Food and kindred products	$10,418,536,000
Textiles and their products	9,122,858,000
Iron and steel and their products, not including machinery	6,461,688,000
Chemicals and allied products	6,438,027,000
Transportation equipment—air, land, and water	5,451,753,000
Machinery, not including transportation equipment	5,020,281,000
Paper, printing, and related industries	4,143,685,000
Lumber and allied products	3,688,552,000
Metals and metal products, other than iron and steel	2,833,770,000
Miscellaneous industries	1,815,570,000
Leather and its finished products	1,767,581,000
Stone, clay, and glass products	1,640,652,000
Railroad repair shops	1,332,679,000
Rubber products	1,255,414,000
Tobacco manufactures	1,091,001,000
Musical instruments and phonographs	231,687,000
TOTAL	$62,713,714,000

We may obtain another view of the diversification of American industries. The sixteen groups mentioned above contain about 335 distinct industries. But, in many cases, these individual enterprises specialize in only one product; but the condition may range from this most simple situation to an enterprise which produces the full line, or even to the integrated company which manufactures a considerable number of related products. To give several examples: The manufacture of knit goods is one of the simplest divisions in the textile group; but some companies specialize in the production of hosiery, some in fancy knit goods, some in underwear—shirts, drawers, union suits—and some in knitted cloth. But there are other variations because some producers may specialize in fabrics of silk or cotton or wool or even mixed materials, while, on the other hand, some companies combine the manufacture of two or more of these materials.

A similar illustration may be taken from the food-product group. Canning and preserving is one of the most elementary divisions. But many companies specialize in one or another of

THE VALUE OF THE PRODUCT OF CERTAIN GROUPS OF INDUSTRIES
UNITED KINGDOM, 1924

Group	*Value of Product*
Textiles and clothing	$ 2,513,118,000
Food, drink, and tobacco	2,028,942,000
Engineering (machinery, etc.)	1,601,914,000
Iron and steel	1,322,962,000
Mines and quarries	1,213,356,000
Paper trades	617,011,000
Motors and cycles	414,408,000
Nonferrous metals—smelting, rolling, and casting	332,153,000
Railway companies—construction and repairs	312,408,000
Shipbuilding	286,612,000
Chemicals and allied trades	271,178,000
Rubber trades	102,958,000
Brick and fire clay	91,085,000
Heating, ventilating, and sanitary engineering	77,966,000
China and earthenware	76,950,000
Railway cars	70,099,000
Linoleum and oil cloth	50,072,000
TOTAL	$11,383,192,000

the canning industries. Some confine attention to a few fruits or vegetables grown in the vicinity. Others produce a considerable range of articles. Some devote attention largely to vegetables, others to fruits, still others to fish. And in these cases, also, the character of the business is sometimes determined by a near-by supply of raw materials. Further, some enterprises engage exclusively in the canning and preparation of oysters; others produce soups, pickles, jams, preserves, marmalades, with the usual variation of groupings. The nature of the canning business is affected by a number of conditions, including the character of the supply of materials, the amount of capital which the managers can command, and market conditions. But whatever the character of the industry, the divisions reported in the Census are often represented by a great variety of specialized industries.

The raw-material requirements are even more diversified than the industries themselves. And, it might be added, that all these varied enterprises are a part of the economic organization of the country and make use of its varied commercial facilties.

THE CASE OF GREAT BRITAIN

British industries are not as diversified as those of the United States; but this country contains a large number of specialized undertakings which are bound together in an economic organization similar to our own. The figures given in the table on page 92 are taken from the incomplete returns of a Census in 1924. Many of the smaller groups of industries were not included.

CONTINENTAL EUROPE

The diversification of industries is not peculiar to any one country, although it is a distinguishing characteristic of the great industrial nations. Growing specialization and division of labor are features of economic development; industries become more varied as specialization takes place. This, of course, is self-evident because these two expressions are practically synonymous. But the character of the varied industries of one country is not like that of others, for reasons which we shall discuss later.

Even a cursory comparison of the manufactures of the United States with those of any European country would reveal notable differences. For one thing, the great agricultural resources of this country have impressed certain peculiarities on our industries; and the peculiar mechanical genius of our people, and the state of our markets are factors of no less importance in establishing industrial differences in this country as contrasted with Europe. At times, slaughtering and meat-packing has been our greatest industry; the milling of flour and the production of confections also have a high rank among our manufactures. Likewise, the great timber resources of this country give our manufactures another distinguishing feature. In 1925 the output of lumber and allied products in the United States was valued at $3,688,500,000. But this group is of relatively small importance in the industrial nations of Europe. In Britain, for example, there is very little available standing timber, and it is necessary to import supplies from the United States, Canada, Norway, and Sweden.

To take an illustration from a relatively new industry, the manufacture of motor vehicles is much more diversified and extensive in the United States than in any country in the world. In 1925 it was our largest industry. The extensive use of power machinery, the application of the principles of quantity production, the development of by-product industries and the integrated nature of many of our manufactures give a character to our varied industries which is not revealed in any other industrial nation.

On the other hand, Great Britain is preëminent in the production of certain kinds of textiles, in which climatic conditions and the skill of her workers seem to give certain advantages; this is notably the case with linens in portions of Scotland and Ireland, and in England with the finer qualities of cottons and woolens. Many French industries are characterized by art and skill of workmanship—a feature which gives this country a great advantage in foreign trade where commodities must have some distinguishing features to hold their own under the severe strain of international competition. In Germany, where chemical research and technical education have been so highly developed, it is natural that this feature should be impressed on many industries. In Switzerland, where there is almost a total lack of physical resources, except mountain scenery and some water power, manufactures must be adjusted to what the people can be trained to do in technical and other schools; and it is not surprising that the prosperity of the export trade depends on individuality of craftsmanship, which distinguishes Swiss products from those of other nations. Thus, while classes, or groups, of industries may seem to bear great similarity among the nations, there are vast differences in the nature of particular enterprises.

There are great differences, also, in magnitude. The American Census for 1925 gives the value of the manufactures of this country as about $62,000,000,000; the incomplete returns of the United Kingdom for 1924 gave the value of British manufactures as about $11,300,000,000; and the German estimate for the value produced in that country in 1925 is about $15,000,000,000. Thus, the United States with a population about two and a half that of the United Kingdom produced manufactured goods valued at about five times as great; and with a population somewhat less than twice that of Germany our manufacturers produce goods valued at about four times the value of the German product. To state this idea in other words: The per capita production of manufactures in the United States is about $545; in the United Kingdom about $260; and in Germany about $240. Some idea of the relative importance of the ranking industries of Germany may be obtained from the following table:

PERSONS EMPLOYED IN MANUFACTURING INDUSTRIES IN GERMANY, 1925

Industry	*Employees*
Clothing	1,436,215
Food products	1,345,664
Machinery and vehicles	1,220,553
Textiles	1,196,120
Wood and its products	945,357
Iron and other metal ware	852,690
Stone and earth	652,002
Electric products, technical and optical instruments, etc.	593,000
Paper and printing	569,666
Extraction of iron and other metals	322,154
Chemicals	314,323
Iron combined with other manufactures	292,410
Leather and linoleum	164,650
Musical instruments, toys, and sporting goods	118,616
Rubber and asbestos	67,712
TOTAL	10,091,132

CAUSES FOR DIFFERENCES IN NATIONAL INDUSTRIES

At first thought one would say that physical conditions, such as mineral and field resources and climate, lie at the base of these differences; but the matter is a great deal more complicated than this statement would lead us to believe. But it is true that to some extent the natural products of a region give character to some of its manufactures. A partial explanation of the high rank of the food-product and timber manufacturing industries in the United States is found in the prolific nature of American resources. But this is not the whole case.

The character of a people has much to do with the kind and qualities of the manufactures. We have discussed this question in the chapter on The Human Resource. But we may add that practically every nation makes conscious effort to direct industrial energy into channels which statesmen think will promote the national welfare. This is a reason for encouraging the development of trade and technical education, and for national policies framed to encourage certain kinds of industries and to promote the expansion of foreign trade.

Moreover, the accidents of invention and discovery are sometimes forces of great moment in giving character to the industries of a nation. National legislation may emphasize the results which invention has begun. The student is probably aware of the careful efforts of the British government, some hundred years ago, to prevent British inventions from getting into the hands of foreigners. Even now, most nations guard the secrets of their industries. For this reason nations sometimes follow quite different courses of development. Further, the momentum of organization and technical improvement often marks out a new direction for expansion. Technical improvements grow by a process of association of ideas. One invention suggests another; an improvement in one industry paves the way for development elsewhere. In time, with the accumulation of new ideas, a broad basis is laid for an era of extremely rapid growth. The industrial history of the United States during the last fifty years is a splendid example. The stream of inventions flows much more rapidly in some countries than in others and, therefore, marked contrasts make their appearance in the industrial conditions of the nations.

Traditions of taste and skill of workmanship produce similar results. For years traders sought the markets of China and Japan for commodities which only those countries could produce. Even today those countries manufacture articles which are notably Japanese, or Chinese; and the same statement applies to other countries. The American lady of fashion still bows to Paris creations and esteems French novelties above those of other nations. At times certain traditions seem to retard the normal course of development; in this respect, also, tradition is a cause for national industrial differences. In some European countries there is a strong desire for individual or family ownership of industry. The founder of the enterprise wishes to perpetuate the family name, and to pass the business on to his sons—a condition which retards the combination of enterprises, and delays their growth in size and effectiveness.

Wealth is always a source of power, but in addition, in industry it is an important cause for the growth of diversification. New ideas are of little avail unless the people of a nation can command the capital to make them effective. Large supplies of capital not only enable the business managers of a country to put their enterprises on the most effective basis, but to push their foreign trade, to gain access to foreign supplies of material, and to make prompt use of new inventions and discoveries.

Finally, in our quest for explanations of the characteristic features of national development we must not overlook the fact that all the factors named above are in constant interaction. No economic force operates alone. It combines with other forces, operating in one way in one country and in quite a different manner in another. Diversification of industries is inevitable, but the course which this development takes depends upon the functioning of the combined forces.

RELATION OF DOMESTIC TO FOREIGN ECONOMIC ORGANIZATION

The economic organization of one country overlaps that of many others. The expansion of commerce, the growing specialization of industry, and the development of wealth—some of which seeks an outlet in the form of investments in the foreign world—are some of the reasons why the national economic organizations interlace at many points. Further, the growing exactions of highly specialized industries make necessary a world-wide quest for raw materials to satisfy the specific needs of industry.

American resources supply by far the greater portion of the raw materials used in domestic industries. In many cases, as with short staple cotton, lead, zinc, copper, a number of the countries of the world look to the United States as their chief source of supply. But, on the other hand, this country is a large importer of raw materials, and in some cases these materials are similar to those which we produce on a large scale. In 1926, for example, the imports included considerable quantities of iron and copper ore, long and short staple cotton, pork, beef, mutton, canned meats, corn, and wheat. We also imported large quantities of wool ($106,700,000), rawhides and skins ($96,800,000), and petroleum and its products ($124,500,000), although in each case the United States is among the most important producers in the world. In some instances, the occasion for the import was a difference in price level at home and abroad; but in other cases there was a need for mixing or blending with domestic products, or of greater convenience to supply domestic plans which are more accessible to the imported than to the domestic product.

American imports also include a long list of commodities of which this country has little or no supply. The list includes nickel, tin, platinum, rubber, precious stones, many kinds of drugs, dyes and gums, cork, jute, sisal, silk, cacao, coffee and tea, a number of vegetable and essential oils, and tanning and dyeing materials.

The industrial nations of Europe are much more dependent on foreign raw materials than is the case with the United States. In 1926 the United Kingdom spent abroad for food products (raw and manufactured) about $1,500,000,000; for textile fibers $735,000,000; and for mineral and partly finished metal products $436,000,000. In the same year Germany spent $538,000,000 for food products; about $279,000,000 for textile fibers, and $173,000,000 for mineral and metal products. The total expenditures of France for these three classes of commodities was about $778,000,000. This signifies that many kinds of contacts were made by the economic organizations of these countries with similar organizations beyond their borders.

CLASSIFICATION OF FACTORS IN THE ECONOMIC ORGANIZATION

In a modern industrial nation the ramifications of industrial relations are too numerous and too intricate to be presented in tabular form. But a summary outline will give some idea of the extent of this system. These economic activities may be classified into four groups, namely, (*a*) industries which produce raw materials; (*b*) manufacturing industries; (*c*) commercial industries; and (*d*) professional service employed in industry. In some of the large enterprises all these classes of activities are integrated under one control. That is to say, some companies produce their own raw materials, fabricate these products into finished commodities, and direct a considerable part of their own market machinery. The extent of these activities varies from company to company, and from industry to industry. The following outline is presented with these limitations in mind:

I. Industries engaged in the production of raw materials
  A. Farm and plantation products
    1. Cereals
    2. Textile fibers
    3. Livestock
    4. Forage
    5. Fruit
    6. Vegetables
    7. Drinks (coffee, tea, cacao)
    8. Gums, etc., including rubber
  B. Forest products
    Many timbers which may be classified in various ways, such as cabinet woods, dye woods, hard woods, etc. Also many native gums, resins, dye materials, drugs, and fibers.
  C. Mineral and related products
    1. Iron
    2. Coal
    3. Copper
    4. Lead
    5. Zinc
    6. Petroleum
    7. Gold and silver
    8. Other minerals containing tin, platinum, tungsten, vanadium, and molybdenum, which are of varying degrees of industrial importance.
    9. Mine and quarry products
    10. Precious stones
  D. Water resources
    1. Fish
    2. Transportation
    3. Water power

II. Manufacturing industries (the Census of the United States gives the following groups:)
    A. Food and kindred products
    B. Textiles and their products
    C. Iron and steel and their products, not including machinery
    D. Lumber and allied products
    E. Leather and its finished products
    F. Rubber products
    G. Paper, printing, and related industries
    H. Chemicals and allied products
    I. Stone, clay, and glass products
    J. Metals and metal products other than iron and steel
    K. Tobacco manufactures
    L. Machinery, not including transportation equipment
    M. Musical instruments and phonographs
    N. Transportation equipment, air, land, and water
    O. Railroad repair shops
    P. Miscellaneous industries

III. Commercial industries
    A. Buying and selling (including wholesale, retail, commission, mail-order, and direct selling)
    B. Transportation
        1. Rail
        2. Water
        3. Road
        4. Air
    C. Banking
        1. Commercial
        2. Investment
        3. Savings
        4. Trust companies
    D. Insurance (including fire, tornado, fidelity, indemnity, life, etc.)
    E. Storage
    F. Communication service
        1. The post office
        2. Telegraph, telephone, and wireless
        3. Newspapers and trade journals
        4. Credit-rating companies

IV. Professional service employed in industry
    A. Legal
    B. Medical
    C. Economic
    D. Engineering of various kinds (mechanical, electrical, chemical, civil, etc.)

This outline is by no means complete, nor can it be made complete without the use of the convenient word "miscellaneous." If items have been omitted which the reader thinks belong in this classification he may imagine that they are included in the miscellaneous group. It may be stated again that these classes of activities are interrelated in most intricate ways with other classes, and that all function together to satisfy the economic needs of the nations. A similar classification, more or less comprehensive, would apply to other countries. And here, too, it may be added that even the national economic organization is not completely self-sustaining because it overlaps similar organizations elsewhere. The activities involved in foreign investment, and in international commercial relations, and the migrations which are set in motion under the influence of economic motives, are sufficient evidence for this statement.

QUESTIONS

1. Does the economic interdependence of region on region, and nation on nation grow with the diversification of industrial activities? Why?

2. "Chance does not decide that tin from the Straits Settlements or from Bolivia shall reach a certain tin-plate manufacturer in the United States." What, then, does decide the routine of delivery?

3. What is the function of an exchange, or a board of trade, in the marketing of such products as cotton and wheat?

4. What is an economic organization?

5. Is there a national economic organization which is distinct and independent of other national economic organizations? Explain.

6. In what ways does an established economic organization speed the development of resources throughout the world?

7. Are varied wants the cause of varied industries? Why?

8. Explain how the process of (*a*) diversification of wants and (*b*) diversification of industries develops.

9. How does the growing diversification of industries affect the development of world resources?

10. Give illustrations of the statement that "materials used in manufacture must often meet very exact specifications, depending on the use." What effect does this condition have upon the demands on nature's resources?

11. Compare the varied nature of wants of (*a*) household consumers with that of (*b*) manufacturing consumers. Why are the latter varied?

12. Why are the manufactures of iron and steel and of foundry and machine products among the leading industries in an industrial country?

Do these industries have a high rank in countries where much of the work is done by hand-labor systems? Why?

13. Rank the industries of the United States in the order of their importance (from the point of view of value produced). Account for this ranking.

14. The "great agricultural resources of the United States have impressed certain peculiarities on our industries." What are these peculiarities?

15. Give the causes for the differences in character of the manufactures of the nations.

16. Explain how the accidents of discovery and invention may give character to the industries of a nation.

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PART II

THE DISTRIBUTION AND DEVELOPMENT OF WORLD RESOURCES

CHAPTER VI

THE IRON RESOURCES OF THE WORLD

Iron is by far the most useful metal known to man. In fact, modern civilization could not exist without it. One of the most significant features of the present economic organization is that it is animated by the use of power; without iron the extensive use of mechanical devices driven by the energy from coal, petroleum, and water would be impossible. Iron has contributed enormously to the development of the modern mechanical age, but, on the other hand, the mechanical age has created the present demand for iron. Here, cause and effect are linked in a continuing process.

EARLY TOOLS AND IMPLEMENTS

A little more than a hundred years ago much of the machinery was constructed of wood. Power was transmitted from water wheels to mill by wooden shafts and cogwheels. Heavy machine parts, girders, and beams were made of this material. Many tools and implements were made entirely of wood. This was notably the case with implements of tillage. The only iron on the plow was a small metal strip at the place where the board cut the earth. Rakes, spades, and harrows were of wood, and even the cart was distinguished by the total absence of iron. If perchance a person owned an iron tire he passed it on to his son by bequest, and the son probably repeated the performance. In early railway-building the track was a strip of iron fixed to a wooden beam. Wood was the material employed in all structural works, and builders and mechanics of every description got along without iron as far as they could.

Processes for the production of iron were slow and expensive. In 1700 what was described as the finest iron works in Europe produced only 750 short tons a year from two furnaces, and there was relatively little improvement during the next hundred years. To give a comparison, a modern blast furnace will produce from 400 to 600 tons of pig iron in twenty-four hours, and sometimes the yield is greater. The furnace may be tapped six times a day, from 75 to 100 tons of iron being obtained at each cast. In former years the fabrication of iron was usually performed by hand methods, or at best, with the aid of crude mechanical devices, judged by the standards of today. The production of all forms of iron required a large amount of labor and expense and it was therefore necessary to economize in the use of this material.

But cost was not the only difficulty. Today a machine is required to make a machine. The modern mechanical industry has reached its present perfection by years of preparation in which the significant feature has been the development of an industry which is able to supply promptly to each new industry machinery of any description. This is one reason why the manufacture of automobiles has developed so rapidly, for the mechanical world was ready to serve the needs of the new enterprise. But a hundred years ago there was little or no machine industry, and as a result, each new business had to begin at the bottom and supply its own devices. This means that there was scarcely any organized business to produce machinery, and no adequate devices with which to work. Human strength aided by a few very crude tools were the chief equipments of the industry. Moreover, mechanical science was in its infancy, and little or no knowledge had been contributed by metallurgy—which science today has taught so much about the properties of metals and their combination to produce other highly desirable qualities.

The demand for iron is affected at once by each new invention. Every discovery brings in a new set of uses for the metal; the industry is further diversified by such discoveries, and the demand for materials is increased. With the introduction of the steam engine a basis was laid for the rapid increase in demand for certain kinds of iron and steel. This device was followed shortly by the traction engine which was responsible for the growth of demand for railway iron. This class of use has grown so enormously that today the railroads are the best customers of the iron and steel mills. The invention of agricultural machinery, of methods of producing tin ware, and the great expansion of the production and refining of petroleum are other illustrations of the manner in which iron and steel are benefited by industrial progress. The invention of hoisting machinery, which made possible the modern skyscraper practically created the demand for structural steel, which is now one of the great divisions of steel manufacture; and the introduction of the gas engine, which made the automobile possible, added another industry which is a large consumer of the products of iron. The distribution of use of iron and steel varies from country to country. In the United States, the railway demand usually ranks first, and the building trades, the manufacturers of automobiles, and the producers of petroleum are the next largest consumers. The consumption of steel by the different groups of industry in 1923 is shown in the table given below.

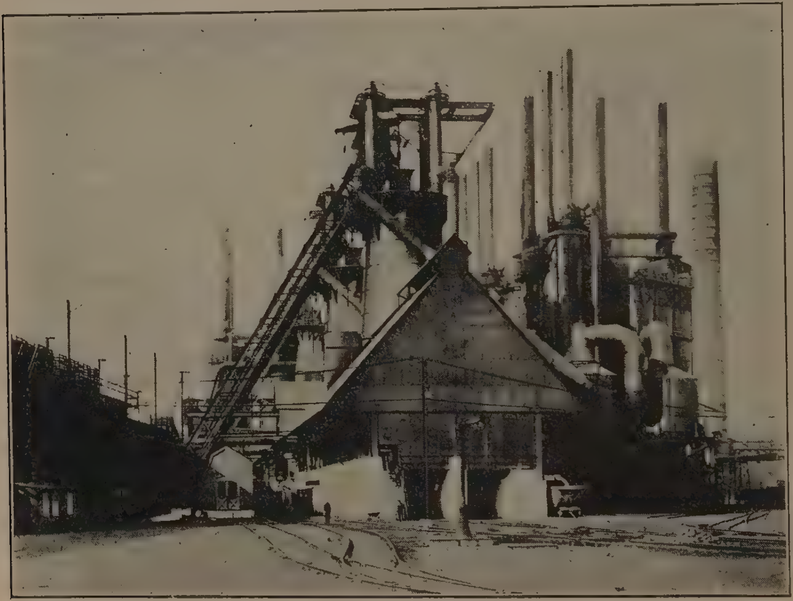
Consumption of Steel in the United States by Industries, 1923

Industry	*Tons*
Automobiles, including trucks, etc.	3,470,000
Railroads, including cars and locomotives	8,590,000
Agriculture	1,200,000
Building, including bridges and other construction, not railway	4,865,000
Shipbuilding	310,000
Containers, principally food	1,100,000
Machinery, electric, textile machines, etc.	940,000
Oil, gas, water, and mining	3,330,000
Export	1,945,000
Miscellaneous	5,830,000
Total	31,580,000

IMPROVEMENTS WITHIN THE INDUSTRY

In a growing economic society production and consumption are alternately cause and effect. The expansion of demand for products of iron and steel encouraged the invention of better methods which lowered the cost, and this in turn made possible an enlargement of consumption. Many of the causes for the development of iron and steel originated within the industry itself. Step by step, over a period of a little more than a hundred years, the business emerged from a stationary position to one of aggressive progress. It is now one of the most efficient industries in the world, using large-scale power machinery and employing the highest type of scientific skill.

We may trace briefly this mechanical progress. As early as 1735 Abraham Darby began to use coke instead of charcoal in the reduction of iron ore. Development was slow for another hundred years. In 1828, James Neilson proposed the heating of the blast, and in 1840, P. Taylor suggested methods for closing the top of the furnace and for using the waste gases. These were steps in the direction of greater economy both in the use of fuel, and in the conservation of waste. Heating of the hot-blast stoves by the waste gases of the furnace was successfully accomplished by various experimenters before 1845. About 1850, Parry



Bethlehem Steel Co.

A modern American blast furnace plant

devised the cap and cone arrangement for closing the top of the furnace, and in 1855, J. P. Budd invented a method for using the waste gases to generate steam. A regeneration stove for heating the blast was invented by E. H. Cowper in 1860. The use of the blast furnace slag for the manufacture of cement is one of the most recent developments in the business.

During the growth of the industry producers have concentrated attention not only on blast furnace construction, but on mill transportation, on economies in the internal organization of the business, on metal composition, and on innumerable details which have harmonized the progress of one department with that of others. Improvement in processes for the manufacture of steel has kept pace with the developments in furnace operation. While the old methods which prevailed some hundred years ago produced a high grade of steel, they were slow and expensive. The new inventions have added enormously to the rapidity of production and have greatly reduced the cost. The Bessemer invention of 1856 inaugurated a new epoch in the steel business, and for more than forty years this process dominated in the manufacture of steel in the United States. Since 1905 it has yielded very rapidly to the open hearth process. In 1926, for example, a little less than 7,000,000 tons were produced by the Bessemer method, while 40,000,000 tons were manufactured by the open hearth process. The latter now provides the cheaper method of freeing pig iron of its various impurities. A large proportion of steel scrap, which can be bought cheaply, is used in this process.

PROPERTIES OF IRON

The availability of iron for modern production purposes is due to a number of peculiar physical and chemical properties. It would not be difficult to name some desirable properties which it does not possess; for example, it is a very poor conductor of electricity, and it rusts readily, a condition which makes necessary a large annual replacement. But its useful properties more than compensate for its shortcomings as an industrial metal. For one thing, by various processes of treatment its original properties may be changed in numerous ways so as to make it available for highly specialized uses. By appropriate methods of manufacture it may be made hard, soft, brittle, malleable, ductile. Wrought iron can be readily forged and welded. The processes of tempering make possible the appearance of other useful properties.

> Generally speaking, steel, when suddenly cooled, is brittle and hard. When slowly cooled, it is soft and tough. This is a very general statement, however, and we may say specifically that steel heated to about 450 degrees F., and cooled, gives the fine cutting edge of razors. When similarly treated at about 500 degrees F. we get the metal used for shears, while 550 degrees F. gives the blue elastic steel of watch springs and of sword blades. The chilling commonly takes place in oil, and is only effective when iron is mixed with carbon. Perfectly pure iron is not tempered by sudden cooling. Wrought iron and cast iron exhibit this quality to some slight degree, but the percentage of carbon in steel seems to be the proper amount for the purpose.[1]

Not only do varying amounts of carbon affect the properties of steel, but the addition of small quantities of certain rare elements impart qualities which are necessary for some kinds of manufactured products. Nickel, vanadium, manganese, tungsten, molybdenum, cobalt, and chromium, among others, are used for this purpose, and since these metals are very unequally distributed over the earth, the supply is usually obtained by exploiting some foreign resource. While consumption is not large, the particular branch of the industry which produces these specialized steels depends absolutely on the supply. This is one reason why large companies seek control over such foreign resources, and not infrequently even governments are interested in such control.

Stainless steel, which is now coming into extensive use, contains about 17 per cent of chromium. One great virtue of this product is that it resists rusting and tarnishing, and is unaffected by many dilute and concentrated acids. Because of the use of this type of steel in table cutlery every housewife will testify that this product is a great blessing. Tungsten or molybdenum is alloyed with steel to produce what are known as high-speed tools; in addition, the better grades may contain a certain amount of chromium or vanadium. Structural steel usually contains a small amount of nickel, for this combination produces a steel of high elastic limit.

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[1] H. Godfrey, *Chemistry*, p. 329.

The automobile industry is most exacting in its demands upon the steel-makers with respect both to the variety of steels required in the business and to the adaptability of properties to particular uses.

> The supporting portions are frequently made of nickel steel; the axles of quaternary steels; the valves of high-chrome steels, which will resist oxidation and corrosion by the hot gases; the wearing parts, such as crank-shafts, gears, etc., of case-hardened nickel steel, often containing some chromium to increase the intensity of the heat-treatment. The springs are made of silico-manganese steel for resilience. The ball-bearings are of chrome steel, or even of quaternary steel, to increase their hardness, etc. What applies to parts of automobiles is still more effectively true of steel for airplanes, which must be as strong as possible, in order to give strength with light weight and reliability.[2]

VALUE OF IRON ORE DEPOSITS

No doubt there are great deposits of iron ore which have not yet been discovered, and there are large known deposits which cannot be worked at the present time at a profit. Progress in the mining sciences has constantly revealed new ways of attacking low-grade and recalcitrant ores, and for this reason the actual potential supplies are much larger than a statement of the extent of present resources would indicate.

Considering our present knowledge, there are four or five important varieties of ore, including hematite, magnetite, limonite and siderite. The first three contain iron compounded with oxygen in various proportions, and the last-named mineral is a compound of iron, carbon, and oxygen. Various impurities are usually mixed with the ores, and these minerals often bear local names. One great feature in the recent development of the mining sciences is that they have revealed not only new methods of locating deposits, but ways for obtaining metal profitably from relatively low-grade ores. Some regions, which are in possession of only poor mineral, are in great need of this new knowledge,

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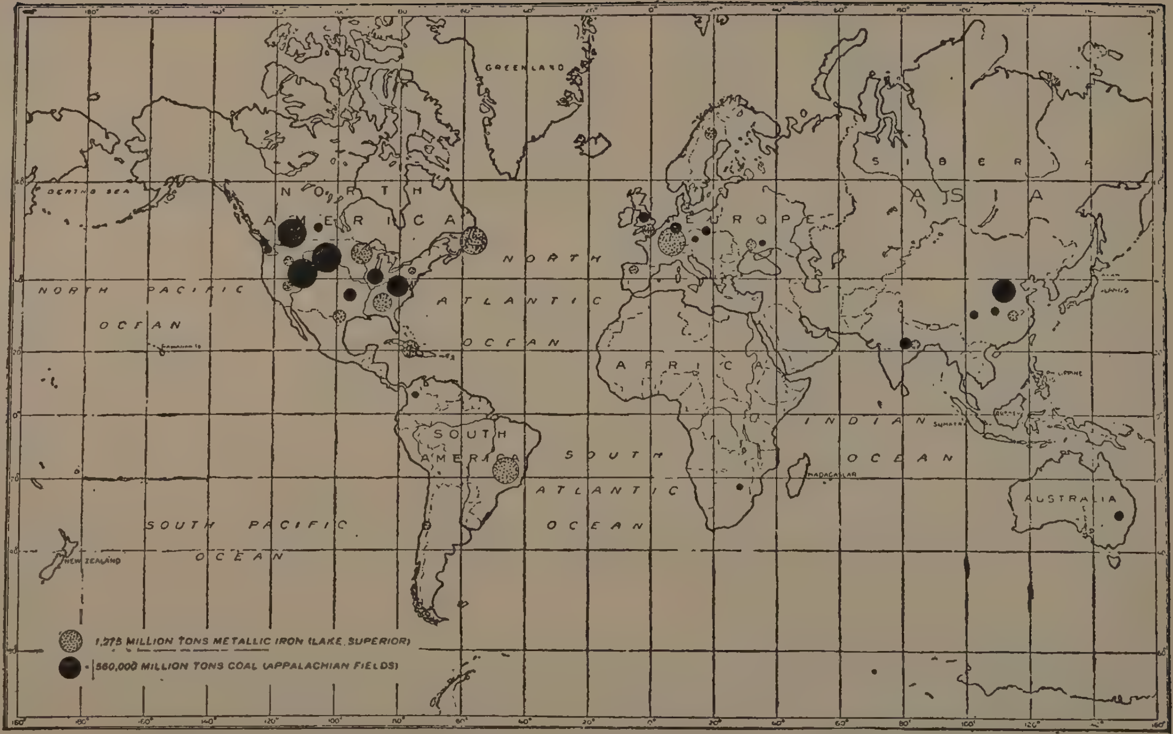
[2] Stoughton and Butts, *Engineering Metallurgy,* p. 194.


GREENLAND
NORTH AMERICA
BERING SEA
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
SOUTH AMERICA
SOUTH PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
NEW ZEALAND
EUROPE
AFRICA
MADAGASCAR
SIBERIA
ASIA
INDIAN OCEAN
SUMATRA
AUSTRALIA
1,275 MILLION TONS METALLIC IRON (LAKE SUPERIOR)
560,000 MILLION TONS COAL (APPALACHIAN FIELDS)

Distribution and relative size of the chief iron and coal reserves of the world but for the most part, the great manufacturing nations are in possession of an abundance of ore of high quality.

Thus, while iron ore exists in many parts of the world, exploitation is profitable only in relatively few places. Large active deposits are found in what is known as the Lake Superior region of the United States, including portions of Minnesota, Wisconsin, and Michigan, and Alabama contains deposits of considerable importance. In the course of development the ironmasters of this country have obtained mineral from many other regions, such as Pennsylvania, Ohio, Kentucky, New Jersey, and New York, and in the earlier stages of our development the bog ores were considered of importance. But most of the ore development in the older states has either been abandoned, or work has been greatly curtailed.

One of the largest active deposits in Europe is in the Lorraine-Luxemburg district, which is the second largest producer in the world. Prior to the War, Germany received the chief benefits of this region, but with the separation of Luxemburg, and the restoration of Lorraine to France, the latter country is now in possession of these great reserves. Other important active deposits are in England, Sweden, and, to some extent, in the Bilbao area in Spain. Russia possesses enormous quantities of ores in the Urals, and near the Donetz coal fields. India, Brazil, and Australia contain deposits of minerals which are now under process of development.

WORLD PRODUCTION OF IRON ORE BY COUNTRIES, 1925[3]

Country	Thousands of Tons	Country	Thousands of Tons
United States	61,908	Russia	1,965
Cuba	558	Spain	4,373
Newfoundland	900	Sweden	8,039
Chile (Tofo mine)	1,313	United Kingdom	10,306
Austria-Hungary		China	1,181
Austria	1,014	India	1,545
Czechoslovakia	1,174	Algeria	1,753
France	35,176	Morocco	787
Germany	4,618	Tunisia	713
Luxemburg	6,567	Australia	747

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[3] *Commerce Yearbook* 1926, Vol. II, p. 625.

The total world production of iron ore in 1925 was about 144,000,000 long tons, of which the United States produced about 43 per cent, France about 24 per cent, and the United Kingdom about 7 per cent. The rest of the production was distributed among some sixteen countries. We give in the table on page 113 the world output of iron ore in 1925.

Producers must, of course, consider the question of profits. Thus various items of cost decide whether a deposit will be worked or not. The extraction of resources is on a competitive basis in which the conditions of production in one region often seriously affect production in others. A very common phenomenon in the extraction of minerals is the abandonment of sources which were formerly worked, upon the development of other areas which reveal a lower cost. For many years this has been notably the case with mining of gold and silver, and more recently with the production of iron and coal. At the present time the production of petroleum is under the same influence. Producers in less favored areas, which have been worked for some time, must find means for reducing their cost, or give up the business. Pennsylvania and Ohio, for example, were at one time leading states in the production of iron ore, but many of the works have been abandoned because of competition from the more prolific resources of the Lake Superior district.

This process of abandonment is always a serious matter for property owners and for capitalists who have invested funds in works, but it is also at times a matter of considerable national interest. To abandon a partially exploited resource involves the loss of a portion of the mineral remaining in the ground, for this remaining material can only be reclaimed at a later date at great cost. Thus the question of competitive exploitation of resources involves the matter of conservation of national resources.

In the prospective development of a resource, transportation is often a deciding factor. Iron ore is heavy and bulky. It contains from 30 to 50 per cent of non-usable material, depending on the purity of the ore, and in many cases it is not profitable to concentrate material for shipment, due to the absence locally of other substances needed for smelting, such as coal and limestone. However, low-grade ores, situated at a distance from the market,

Keystone View Company

Open-pit mining of iron ore on a Minnesota range

are sometimes worked where conditions of fuel, labor, and transport permit a profit to the business. In such cases, ore may be concentrated for either domestic or foreign shipment. Abundance of water power may redeem what would otherwise be a high cost condition. In northern Norway low-grade ores are concentrated with the aid of this power.

Other factors affect the commercial value of ore. The presence of sulphur, phosphorus, silica, and arsenic are considered as detrimental, and titanium is sometimes a troublesome element. But whether a mineral can be used depends partly on the existing knowledge of mining and manufacturing methods. In time, the experts in the mining industry will learn how to deal with elements which are now considered injurious. The growth of knowledge of this kind increases the availability of world resources. The value of deposits depends not only on the character of the ore, and on its chemical composition, but on its texture, its location with respect to blast furnaces, and the distance of the deposits from the consuming areas. Since cleaning and beneficiating are items of expense those ores are often preferred which do not require preliminary treatment.

DESCRIPTION OF LAKE SUPERIOR DEPOSITS

Since the lake region of America is now the most important single source of ore in the world, it may be worth while to learn some of the factors which account for the position of the region.

> The mines of this region are located at an elevation of from 1,000 to 1,500 feet above Lake Superior, the distance from the lake varying from a few to a hundred miles. The output finds cheap transportation for the rail haul to the lakes, has grades favorable to the traffic, and on the lake shore extensive and well-equipped docks have been constructed . . . where the ore coming in train loads is received into bins, and delivered from the bins by gravity into the holds of vessels. The vessels take the ore from the shipping docks and carry it through two or more of the Great Lakes to receiving docks where equal facilities for unloading by mechanical appliances have been provided. In this way enormous quantities of ore are handled cheaply and expeditiously. The Lake Superior region is also unique in that its location is such that ore can be delivered at furnaces in a populous section of the country, and there meet a cheap fuel supply; in other words, its market facilities are unexcelled. It has been this which has chiefly encouraged the phenomenal development.[4]

The iron ore deposits of the Lake Superior district are hematite, and this is largely the character of the ores in the Birmingham district. New York, New Jersey, and southern Pennsylvania contain large quantities of magnetite. At one time or another hundreds of local resources in the region east of the Mississippi River have been worked, but since 1870, with the development of transportation which brings these areas into contact with the great iron manufacturing centers, and with the rapid development of the northern mines, most of these enterprises have been abandoned.

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[4] Report of the U. S. Census, *Mines and Quarries* (1902), p. 409.

The development of the lake resources dates from about 1855 when the output was about 1,500 tons. Production in 1880 amounted to 1,948,000 tons, and in 1926 to 57,143,000 tons. This region produces nearly 85 per cent of the total iron ore mined in the United States. About 10 per cent of the total is mined in the Birmingham district.

The iron ore reserves of the United States are estimated at 4,700,000,000 gross tons. Of this 3,500,000,000 gross tons are in the Lake Superior area, 355,000,000 in the Birmingham district, and 260,000,000 compose the limonite ores in northeastern Texas.[5]

ORE RESERVES OF EUROPE

Scattered through Europe are many deposits of iron. Some have only local importance, but the deposits in at least a half dozen areas are large enough to support a great iron industry for many years to come. Norway, Sweden, and Spain, which possess great reserves, are chiefly exporters, and since the general industrial conditions in those countries do not favor a varied iron and steel industry, their resources will probably be used chiefly to supply some of the present great manufacturing areas. Swedish ores have been used in England for centuries, and competitive conditions seem to foretell a larger dependence on Sweden in the future than at any time in the past. While Britain has great deposits, the composition is, as a rule, inferior to those of the countries from which she might import. The Swedish reserves are chiefly high-grade magnetite, while British ores are largely carbonate and hematite of much lower grade. In recent years the United Kingdom has been importing relatively large quantities of ore—4,300,000 tons in 1925—and this relation to the foreign supply of ore is tending to draw the iron manufacturing industry away from its old centers to locations which are more accessible to imported ores—a condition which will still further encourage the use of foreign ore. Here, as elsewhere, the extent of the reserve is not the only thing that counts; an important factor is the competitive conditions under which the mineral industry must operate.

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[5] J. E. Spurr, ed., *Political and Commercial Geology and the World's Mineral Resources,* p. 61.

In some of the countries of Europe the lack of near-by supplies of fuel is a handicap to the development of the iron industry. These conditions may be presented in a general way as follows:

> The future of the iron industry of France and Germany will depend on their coöperation. The extent to which Westphalian coal and Lorraine iron ore are utilized together will measure the extent of their success or failure. Luxemburg also is dependent on Westphalian coal but has not sufficient iron ore to export it to Germany in exchange for coal. Belgium is almost entirely dependent on foreign deposits of iron ore to supply her blast furnaces, and she has in the past drawn on Westphalia for coal to augment her supplies. Czechoslovakia and Russia are almost entirely independent as to raw materials. Italy lacks coal and does not make much pig iron, but she has developed a very good steel industry from imported material. Austria is dependent on foreign sources for coal. If she is to use English coal, as she has in the past, she must import it through territory that has been hostile to her. Poland has not the resources to develop more than a small iron industry. Switzerland, Holland, Denmark, and the new Baltic states have no resources of their own on which to base any extensive iron industry.[6]

The European iron and coal situation is complicated by the existence of a number of nations—and the treaty of peace which concluded the late War increased the numbers—which are inadequately supplied with the essential materials for the development of iron and steel and related industries. The success of the industry is therefore dependent on the policy of the nation which possesses the needed supply. Tariff arrangements still further complicate the matter. In view of these conditions it is not surprising that in the past nations have tried to liberate themselves from this dependence by seeking control of outside sources of supply. National industrial rivalry is often more destructive, and works through more devious channels, than competition among individuals and companies within countries. If control cannot be obtained by conquest, some other method will be employed, possibly through cartel arrangements, or through some system of economic penetration. These matters were discussed in a former chapter.

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[6] U. S. Geological Survey, Bulletin No. 706, p. 29.

The known ore reserves of Europe have been estimated recently at about 3,700,000,000 metric tons. If we add to this sum the possible and probable resources the total European iron reserves may amount to 12,400,000,000 metric tons.[7]

KNOWN IRON RESERVES OF EUROPE

Country	*Metric Tons*
France	1,790,000,000
United Kingdom	317,000,000
Sweden	442,000,000
German Republic	255,000,000
Spain	353,000,000
Central Russia	140,000,000
Norway	85,000,000
Southern Russia	71,000,000
Ural region	52,000,000
Austrian Republic	76,000,000
Luxemburg	60,000,000
All others	94,000,000
TOTAL	3,735,000,000

Of course, all estimates are subject to great limitations. In the first place, the extent of a reserve cannot be known, and even after extensive development there is still uncertainty as to the remaining contents. Moreover, the sciences which study the subsurface contents of the earth are still in their infancy; even now methods are being developed to enable prospectors to locate new sources, and to give better estimates of those which have been under development. Nor is this all. Technical improvements and inventions are even now changing the aspect of the industry in such a manner that ores which were formerly considered useless may now be worked with a profit. Electric smelting seems to offer great possibilities of this kind not only by making possible the development of ores which exist at great distance from coal supply—provided there is water power—but by enabling producers to attack lower-grade ores. Finally, the significance of all estimates is affected by the introduction of methods of conserving an existing supply. While such methods do not increase the extent of a resource, they prolong the life of the reserve, and thereby increase the use. Estimates, therefore, are only tentative. With this in mind we may give the above statement of the distribution of the iron reserves of Europe.[8]

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[7] Max Roesler, *ibid.,* p. 18.

RESERVES IN OTHER PORTIONS OF THE WORLD

Estimates for those countries where little or no development has taken place are even more uncertain than in the case of the older regions. Great portions of Asia and Africa have not been explored. From some indications China contains enormous iron resources. The information is a little more definite about some portions of Latin America. South Brazil, for example, contains great deposits, although the extent is mere conjecture. Estimates vary from three to seven billion metric tons. If this even approximates the case a relatively small area in south Brazil—the state of Minas Geraes—contains more iron than all the countries of Europe. The reserves of Cuba are estimated at about 1,000 millions metric tons. Chile contains rather important deposits, which are now controlled by an American company.

Estimates of the total iron resources of the world are even more uncertain. The International Geological Congress meeting at Stockholm in 1910 placed the world reserves, which can be profitably worked with our present knowledge of the mining industry, at about 10,000 millions of tons. The potential reserves were thought to amount to 424,000,000,000. The limitations on estimates, suggested above, also apply to these statements.

But whatever the earth contains we may make this statement safely, that considering the enormous potential demands of the future the reserves are none too great. The most populous parts of the world, such as China and India, have scarcely begun to consume the products of iron, at least in the manner in which we use these products in the United States. The annual per capita consumption of steel in this country, on the basis of steel ingots, is about four-tenths of a ton. In India it is less than one-twentieth of this amount, and in China it is still less. When the people of these two countries, with a combined population of about 760,000,000, begin to use iron and steel on somewhat the scale of the United States the tax upon the natural resource will be many times greater than it is today. Since the low cost available resources are always developed first, and the development of poorer mineral is postponed for future use, the future cost will be on an ascending basis, unless mining and manufacturing technique can keep pace with the growing demand.

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[8] *Ibid.*

In considering the future of the world demand for iron we must take account of another important factor. Possibly the greatest disadvantage in the use of iron is that it rusts or corrodes. In many of its uses the metal must be exposed to the elements, and this involves a natural wear and tear which is as yet largely beyond the control of man. In some instances the metal may be protected as with paint, or by coating with zinc or tin, or now perhaps, to some small extent, by conversion into so-called rustless steel. A considerable amount of structural steel is protected by encasement in cement. Moreover, some iron and steel goes back to the mill as junk and scrap and in that way is reclaimed. But, at that, the annual wastage is large. Much of the iron which goes into containers and into domestic use is irretrievably lost. Possibly 25 per cent of the present annual production is to replace metal which has been worn out or destroyed. This wastage increases with the growth of consumption, and it will consequently become much more of a problem in the future than it has been in the past.

DEVELOPMENT OF THE IRON AND STEEL BUSINESS

The expansion of the demand for iron and steel, and consequently the growing diversification of the industry, has been contemporary with the appearance of new uses for these products. The development of railroads, the coming of steel structures, the introduction of the automobile, and the rapid development of petroleum resources have been the greatest contributors to the expansion of the iron and steel business. Many minor demands work to the same end. These new features operate most extensively in the United States, and consequently the steel business of this country has been the greatest beneficiary of the new developments. As a matter of fact, the modern expansion in this, as in all American metal industries, dates from about 1880. In the decade from 1881 to 1890 the average annual production of iron ore was only 10,300,000 tons; it amounted to 67,600,000 in 1926. The production of steel ingots and castings amounted to only 1,600,000 during the five years from 1881 to 1885 and to 48,200,000 in 1926. In 1925 the rank among the nations of the world in the production of iron ore was the United States, France, the United Kingdom, Sweden, Luxemburg, and Germany, given in

Baldwin Locomotive Works

A modern American machine shop

the order of their relative importance as producers. In the case of cast iron, the United States produced only about 12 per cent of the total for the world in 1850, and about 48 per cent in 1925. The relative position of the great nations in the production of steel is shown in the appended table.

World Production of Steel for Certain Periods from 1880 to 1926

(*Tons*)

Year	United States	United Kingdom	France	Germany	World
1880........	1,267,000	1,320,000	389,000	624,000	4,274,000
1900........	10,382,000	5,130,000	1,642,000	6,645,000	28,342,000
1926........	48,580,000	3,500,000	8,245,000	11,905,000	91,228,000

The four countries named in the table are the chief sources of the iron and steel products which enter international trade. The figures are not strictly comparable because the classes of exports are different, but these exports may be compared roughly as follows: the United States, $1,005,000,000; the United Kingdom, $648,800,000; Germany, $588,200,000; and France, $309,200,000. These figures are for 1926 and include iron and steel and various kinds of machinery including automobiles. In this year the exports of similar products from Belgium and Italy amounted to about $40,000,000 in the case of each country. A considerable amount of iron ore moved in the international trade, the chief exporters being France, Sweden, and Spain, given in the order of importance. The total exports from these countries amounted to about 23,000,000 tons. Germany and the United Kingdom were the chief importers.

The United States is also an importer of foreign ores. Since 1921 we have imported on the average about 2,000,000 tons a year. A considerable amount of this outside ore comes from properties of the Bethlehem Steel Company in Cuba and is used at the Sparrow's Point plant of this company. The same organization imports Swedish ores to supplement the product from Cuba. But other American steel companies import material, as for example, the high-grade phosphorus ores from Spain and North Africa.

CONTINENTAL STEEL AGREEMENT

Practically all the iron- and steel-making countries of Europe were threatened with an excess of producing capacity even in 1913; but the overstimulation of the industry during the War has made overproduction a real problem. Competition has been severe since the return of peace. The steel-makers profess to believe that this excess capacity is only temporary, and that if they can tide over the present situation the industry can be stabilized. Thus the way out of the present trouble is combination. The European Iron and Steel Agreement was signed September 30, 1926, by representatives from Germany, France, Belgium, Luxemburg, and the Saar. The German producers had previously entered into an agreement of a similar kind in 1924, applying to the home country.

The international agreement provided for an allotment of quotas among the participants on the basis of their production during the first quarter of 1926. Some allowance was made for Belgium which was still suffering from the effects of a strike. The German quota was about 40 per cent, that of France 40 per cent, and so on. Provision was made for the readjustment of these quotas from time to time, with the change of market conditions. This matter was entrusted to a managing committee constituted of representatives from the participating countries.

There was no arrangement for the fixing of prices, or for the partitioning of markets. Instead, the organization provided for a system of fines for production in excess of allotment. The agreement terminates April 1, 1931, but under certain conditions it may be brought to an end at an earlier date.

CONTROL OF FOREIGN IRON RESOURCES

In a former chapter we discussed the effect of foreign investment on the development of resources. A considerable amount of capital from the industrial nations has been invested in ore properties, and in some instances in iron and steel works. In a few cases the aim is to obtain an income, but a more important purpose is to control resources in order to secure an adequate present or future supply of ores for home industries. Some countries even now require foreign mineral, and others, at no distant date, will face depletion of their best ores and thus will be dependent on outside sources. For these reasons they are making provision for the future.

At least four nations have received large concessions covering ore deposits in Brazil. Upwards of 1,500 millions of tons are controlled in this manner by English, German, American, and French capitalists. American, Dutch, and German capital controls iron reserves in Chile. American capital is invested in certain Canadian properties, and Swedish and German capital is invested in Norway; English and German capital in Sweden, and some German capital is invested in Spain.

Japan presents an interesting situation. The iron and steel industry is expanding rapidly, and producers look forward to the time when they can supply large amounts of finished steel products to the Far Eastern markets, if not to the Pacific seaboard of the United States. Domestic consumption, also, offers new opportunities. But Japan contains only small iron reserves, and it has become necessary both to import ore, and to invest capital in outside blast furnaces and steel plants. For these purposes Japanese capital has been invested in China, Manchuria, and Korea. The effect of these investments is not only to develop the resources, but to involve the capitalists, and possibly countries, in the meshes of international control.

QUESTIONS

1. If possible justify the statement that "modern civilization could not exist without iron."
2. In what ways does a highly developed machine-making industry speed industrial progress?
3. Could the automobile industry have been developed rapidly without the prior development of a machine-making industry?
4. "Every invention and discovery brings in a new use for iron." Give some illustrations.
5. Why does the "distribution of uses" for iron and steel vary from country to country?
6. Give an estimate of the importance of the invention of the Bessemer process of making steel.

7. What are the chemical and physical properties of iron which make it an important industrial metal? Is there any adequate substitute for iron?

8. What are the greatest shortcomings of iron as an industrial metal?

9. Why do large manufacturers of iron and steel often seek to control foreign resources not only of iron, but of the rarer metals?

10. In what ways does the development of scientific knowledge increase the availability of the world's iron ore reserves?

11. The "extraction of resources is on a competitive basis in which the conditions of production in one region often affect production in another." Explain and give illustrations.

12. How is the question of conservation of iron resources connected with the question of competitive exploitation?

13. In what ways do relative costs of production determine when and where a resource is to be developed—or abandoned?

14. Does the present localization of iron resources seem to make international cartels necessary? Why?

15. Is there a probability that the cost of producing iron ore will increase in the future, as the best reserves are used up? Are there conditions which might make for lower cost even if it becomes necessary to work poorer resources?

16. What are the estimated potential reserves of iron ore? Where are these located? How many years will these last at the present rate of consumption?

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CHAPTER VII

COAL

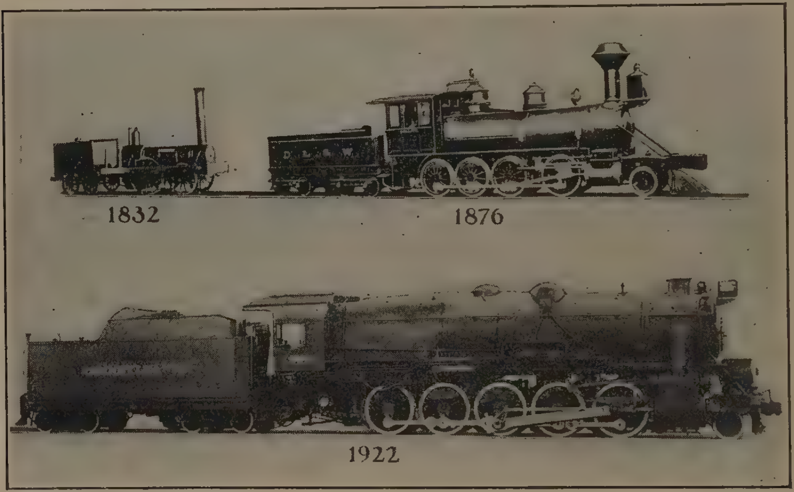
The extensive use of coal is one of the outstanding results of modern industrial civilization. But if this mechanical age has created the coal industry, coal, on the other hand, has made the mechanical age possible, because it is the great source of power, notwithstanding the fact that its position in some uses is being challenged more and more by petroleum, and more recently by electricity generated by water sources.

IMPORTANCE OF COAL

Mechanical devices driven by the energy from coal make two great contributions to industrial progress: First, they manifold human labor; and second, they make possible the concentration of power so that it can be used most effectively for industrial purposes. In mechanical terms the rate of doing work is called power, and presumably a power device is a machine which can do a great amount of work compared with what can be accomplished by a man unaided by the machine. Comparisons, of course, have their limitations, but it is assumed that the power of an ordinary man is one-seventh horse power. Now the power of an ordinary locomotive may be from 500 to 1,000 h. p.; some stationary engines run with 20,000 h. p. or more. On the basis of one-seventh, an ordinary locomotive represents the power of from 3,500 to 7,000 men, and a stationary engine of 20,000 h. p. represents 140,000 men. These rough comparisons convey some idea of the extent to which a machine manifolds the power of man.

But this is not all. It is inconceivable that 7,000 men could apply the power in dragging a freight train, or that 140,000 men could use their energy in any possible way in turning the machinery of a factory. Thus, in addition to manifolding power, the machine makes possible the concentration of mechanical energy into such a small area that it can be used most effectively for industrial purposes.

The manufacturing establishments of the United States in 1925 employed about 35,700,000 h. p., and in addition about 6,700,000 h. p. were used in mines and quarries. In other words, these two great branches of industry employed more than 42,000,000 h. p., representing nearly 300,000,000 man power. An equal number of persons could not employ their labor in performing anywhere near this amount of work. Thus, by employing the energy of coal the amount of work which the people of a nation can perform is increased enormously.



Baldwin Locomotive Works

Ninety years of locomotive development

By making possible the localization of power, coal is one of the factors in the concentration of people in the cities. To a certain extent it has nullified some of the harsh conditions of climate in the colder parts of the country and has thereby increased the regularity, and probably the quantity of work, which men may perform throughout the year. The influence of coal on the development of transportation, and, because of this, on the further concentration of people in the industrial centers, has been no less important. Commerce could not advance much beyond the primitive stage as long as the only means of conveyance was the packman. Animal transportation added only a little to the facilities of commerce, and even waterways, without power devices, were not an effective commercial aid. In most cases traffic could move only one way, due to the difficulties of traveling upstream. Power transportation, therefore, has liberated commerce from its old inconveniences and has enabled it to move in any direction at all seasons of the year. In the railroad transportation of the United States in 1927 there were about 63,500 locomotives with a total traction capacity of about 2,616,000,000 pounds. In comparison with this, human labor used for transportation purposes could accomplish only insignificant results. The importance of coal as a source of power is thus easily understood. The increasing use of power devices is one of the most significant features of the present age.

> It indicates the substitution of some other energy than that of human muscles, and yields an enormous gain in the natural forces applied to industry. It signifies, also, a much better application of power than could be accomplished with unaided human labor. . . . Power devices, of course, are used in connection with machinery which uses or transmits power. Thus, there has been built up a most complicated system which manifolds power, which speeds production, and which increases the output far beyond the productive capacity of people working without power devices.[1]

From a national point of view this signifies a great increase of competitive strength because it makes possible the most effective use of human labor. It brings about a lower cost of production and an increase in the output per man and per machine. Thus, there is a strategy in the control of coal, for a nation which does not possess adequate sources is at a disadvantage with countries which are amply supplied. From the domestic point of view, the use of power results in high productivity, and presumably in a high return for the men who work, and for those who invest. And this signifies a higher standard of living.

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[1] I. Lippincott, *Economic Development of the United States*, 2nd ed.

In recent years coal has contributed in another way to industrial progress. Experiments have revealed ways of using a great number of the valuable chemicals which are contained in coal. Some of these new commodities are of such importance as to rank as key materials, for without them industry could not be conducted in its present form. Thus the influence of coal is as pervasive as that of iron, although in very different ways.

HISTORY OF COAL

There is no significance in the fact that cinders have been found in the remains of the old Roman camps in Durham and Lancashire, or that small quantities of coal were consumed in certain monasteries in England before 860 A.D. Such industry as there was at the time, and for four or five centuries later, was only an occasional activity and had no bearing on the development of the English trade, except, perhaps, to keep before the minds of the people the utility of coal. This material, obtained by very primitive mining methods, was used for lime-burning and forge purposes as early as the thirteenth century, and from that time to modern days there are records of its use for various purposes.

In some important respects the history of iron and coal are not only parallel but interlocking. The invention of a practical steam engine, however crude, by Thomas Savery in 1698, the Newcomen engine of 1711, and the advent of the Watt engine about 1784 were real landmarks in the development of both coal and iron. The work of Abraham Darby from 1730 to 1735 in showing how coke could be substituted for coal in the smelting of iron was also an important event for both industries. One of the chief purposes of the early steam engines was to pump water out of mines, and the inventors had no conception of the enormous industrial possibilities of these devices. As we have said on former occasions, progress is largely the result of the association of ideas. After the steam engine had been successfully used for one purpose it took no great stretch of imagination to see how it could be used for something else.

As with iron, the immediate effect of many of the epoch-making industrial inventions was to increase demand, and to encourage further improvements in mining and manufacturing. The introduction of the steam engine and the steamboat greatly increased the consumption of coal. Today, railway and industrial steam uses constitute about 55 per cent of the total consumption in the United States. The concentration of people in cities, away from local wood lots, or other sources of fuel, brought into existence a large household use, which today amounts to about 14 per cent of the total consumption. The more recent development of the public utilities has added another important demand. And, of course, the use of coal for smelting purposes has increased rapidly with the growth of the metal industries. And still more recently, the development of a long series of valuable by-products of coal has contributed a further factor to the demand.

Although many observers were familiar with the fact that inflammable gas could be obtained by heating coal in a closed vessel no practical use was made of this knowledge until 1792 when William Murdoch of Redruth, England, constructed a device for heating coal in his back yard, and conveyed the gas by pipe to a burner over a table in one of his rooms. Murdoch continued his experiments with the result that illuminating gas was "first publicly used in connection with an outdoor illumination to celebrate the Peace of Amiens in 1802."[2] In 1810, Parliament granted a charter to a company to supply London with coal gas. The subsequent invention in 1855 of R. W. Bunsen, of Bunsen burner fame—known to every student in chemistry—and of Welsbach from 1885 to 1893, added greatly to the utility of gas. Welsbach discovered that the compounds of certain rare metals possessed unusual powers of emitting light when raised to incandescence. "This mantel, which is got by incinerating a cotton or other fabric saturated with a solution of a mixture of the nitrates of thorium (9.9 per cent) and cerium (1 per cent), gives in conjunction with Bunsen's burner a magnificent white light, and it is not too much to say that the gas industry gained a new lease of life in its competition with the electric light from this second great invention of the Heidelberg chemists."[3] It might be said in this connection that Bunsen, with true professional instinct, had no conception of the commercial value of his invention. His unfinished work in serving humanity was completed largely by Thomas Fletcher of Warrington, whose inventive and commercial genius brought the discoveries of Bunsen to a successful industrial consummation.

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[2] Wm. A. Bone, *Coal and Its Scientific Uses,* p. 269.

[3] *Ibid.*

Other discoveries have stimulated the use of coal. Until about 1880 metallurgical coke was manufactured chiefly in what is known as beehive ovens. These are most wasteful devices for a number of reasons. Coal contains a great number of valuable chemicals, but under the old methods of manufacture no attempt was made to recover these substances, or to ascertain their possible uses. Experiments were begun in the decade from 1850 to 1860, which eventually made the by-product coke process one of the valuable additions to the coal industry, and an important contributor to certain varied chemical products. Thus, in addition to its uses for power, heating, and illumination, coal is now made to yield many substances which are regarded as indispensable not only in industrial, but in household use. And it might be added that these new discoveries have given momentum to the movement to conserve waste, and to organize the coal business on a more effective basis for the delivery of light and power.

Although the United States is both the greatest producer and the greatest consumer of coal, very little use was made of this substance before 1835. In many places the great abundance of timber retarded the development of coal, and, of course, the railroad and industrial use had not yet made its appearance on a large scale. The distribution of the uses of coal varies from country to country. For the United States it is as follows:

DISTRIBUTION OF USES OF COAL IN THE UNITED STATES, 1926

Use	*Tons*
Industrial plants	180,825,000
Railroads	117,714,000
Coke, beehive, etc.	86,200,000
Domestic consumption	72,650,000
Public utility power plants	41,300,000
Export	31,490,000
Bunker	6,910,000
Gas	6,100,000

KINDS OF COAL

As with other materials, modern industry is exacting in its demands upon coal. The manufacturer is primarily interested in the number of heat units which a ton of coal will generate, but other factors enter into his calculations. A varying amount of mineral matter is usually associated with coal and this gives rise to ash when the coal is burnt. An unduly large amount of such substances renders coal undesirable for commercial uses. The blacksmith, the producer of gas, the household user, and the blast furnace operator are particular about the kind of coal they use.

Coal may be classified in various ways—according to its chemical composition, heat value, or physical properties. According to its appearance it is known as peat, brown coal or lignite, bituminous, cannel, and anthracite. Whatever may have been the kind of vegetable matter out of which the various kinds of coal were created, the natural process of production from "vegetable débris" to coal was a "progressive concentration of the carbon content and a corresponding diminution in the relative proportion of oxygen in the organic matter."[4] Thus anthracite, the oldest kind of coal, contains from 90 to 95 per cent of carbon, about 2.5 per cent of hydrogen, and 3 per cent of oxygen, and a small percentage of nitrogen. Peat, on the other hand, contains from 50 to 64 per cent of carbon and from 28 to 48 per cent of oxygen, along with an appreciable amount of hydrogen and nitrogen. The heat value increases with the amount of carbon, and it is thus highest in the case of anthracite. Every part of the world which contains considerable deposits possesses many varieties of coal.

PRESENT WORLD PRODUCTION OF COAL

Coal resources are widely distributed over the earth, but sources have been developed in only a relatively small number of countries. As a matter of fact, the extent of development of coal depends on the state of the industries of the region. It is obvious from what has been said about the expansion of uses, that a country which is still living in the hand labor stage has very little use for coal, because it has no adequate devices for consumption even for household use.

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[4] *Ibid.*, p. 59.

The total production of coal in the world in 1926 is estimated at about 1,494,000,000 short tons; of this amount the United States produced about 663,100,000 tons, including bituminous and anthracite; thus this country produced a little more than 44 per cent of the total for the world. The output of the leading countries is shown in the table.

World Production of Coal and Lignite, 1926

Country	*Short Tons*
United States	663,164,000,000
Europe	
Belgium	27,910,000,000
Czechoslovakia	36,400,000,000
France	57,847,000,000
Germany	314,423,000,000
Saar	14,970,000,000
Poland	39,054,000,000
Russia	27,888,000,000
United Kingdom	140,643,000,000
Asia	
British India	23,149,000,000
China	15,212,000,000
Japan and Taiwan	36,964,000,000

The list of countries producing coal contained in this table is by no means complete. In fact, practically every country in Europe reported some production, and in Asia coal was produced in British Borneo, the Dutch East Indies, the Federated Malay States, and small quantities were mined in the Philippine Islands. Coal was also produced to some extent in Australia and New Zealand.

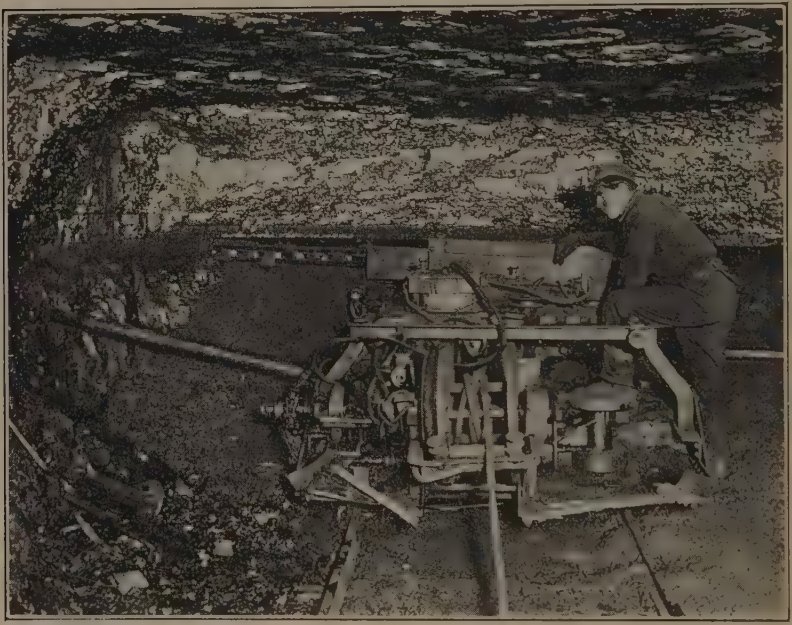
The figures given above for England do not represent normal production. For several years past the English coal industry has been disturbed by labor troubles, and production has declined as a result. The output in 1913 was 321,900,000 tons, and this probably represents what the country would produce today under normal conditions. The German coal industry has undergone a marked change since 1913. The terms of the treaty of peace which concluded the late War brought about certain shifts of coal lands, to the detriment of this country. Upper Silesia, for example, was divided between Germany and Poland, with the latter receiving the chief benefits. The cession of Alsace-Lorraine, and the segregation of the Saar for a period of fifteen years, also affect the position of Germany as a producer. One result of these changes has been to make necessary the greater production of lignite for domestic consumption. While coal production declined from 209,000,000 tons in 1913 to 160,000,000 tons in 1926, the production of lignite increased from 96,100,000 tons to 154,000,000 tons over the same period. Due to economic conditions, including the labor situation, the production of coal varies greatly from year to year in the several regions of the earth. We may summarize the total world production in 1924 by continents.

Production of Coal and Lignite by Continents, 1924

Continent	*Metric Tons*
North America	532,158,000
Europe	712,824,000
Asia	80,059,000
Oceania	16,224,000
Africa	13,685,000
South America	2,050,000
World Total	1,357,000,000

At least one thing is obvious from this table, namely, that the production of coal in a continent has no relation to population. Asia, for example, which contains about 60 per cent of the population of the world produced only about 7 per cent of the coal. Another notable feature is that although certain parts of South America, such as the A. B. C. countries, have displayed a remarkable development during the past twenty-five years, the coal production for the whole continent is insignificant.

In practically all countries the coal industry has been severely criticized for its inefficiencies, and no doubt these criticisms contain a great deal of truth as applied to certain operators and to certain countries. But it is true, also, that in the United States, during the last thirty years, there has been a steady increase in the use of mechanical devices in mining, and a very marked improvement in the character of the organization. This largely accounts for the increase in the average tonnage product per man. With reference to bituminous coal, the average per man in 1890 was 2.56 tons, while in 1925 it was 4.52 tons, and this latter production is the result of a steady increase in the output per man from year to year. Meanwhile, the percentage of coal mined by machinery has also shown a steady increase. In 1890 only 5.3 per cent of our coal was mined in this way, while the percentage in 1925 was 70.6.



Ewing Galloway

Modern coal mining: an electric undercutting machine

The high development of mechanical methods in the United

States throws our industry into strong contrast with that of the United Kingdom, where in 1923 only 17 per cent of the coal was mined by machines. This tardy development of mechanical methods—which may be due partly to the lack of capital by many mine operators, and partly to the influence of tradition affecting the attitude of both operators and miners—is largely responsible for the recent difficulties of the coal mining industry.

COAL RESERVES OF THE WORLD

If anyone experiences the fear that the world may some day run short of coal because of the present great draft upon this resource, he may find some consolation in the fact that the present reserves existing within 6,000 feet of the earth's surface are estimated at 7,397,500 million metric tons. At our present rate of annual consumption this would last for more than 6,000 years. But, at that, we do not need to worry about our descendants a hundred and fifty generations hence because we have every reason to believe that the scientific world will not stand still. There are probably more substitutes for coal than for any other commodity used by man. There are many possible sources of power, including water, tides, the sun, and possibly atomic energy, for to science nothing is impossible. The water power resources of the United States today, available by our present known methods of use, are about equal to the power we could obtain from our present annual production of coal. Many parts of the world have great resources of undeveloped water power. Moreover, there are enormous wastes in our present methods of consumption. An ordinary steam engine will not convert 15 per cent of the heat of combustion into useful work; the locomotives use less than 10 per cent. Domestic consumption is even more wasteful of the energy contained in coal. A similar statement applies to present methods of production. Much coal is left in the mine; a considerable amount is discarded in preparing this commodity for the market, and there is wastage due to exposure to the air. Of course, there is a limit to the prevention of waste, but in time improvements in methods of both production and consumption will point the way to greater economies. This will involve not only a saving of coal resources, but a prolongation of the life of the reserves.

The limitations on our methods of estimating the iron reserves of the world have already been discussed. Similar limitations apply to our estimates of coal. With these conditions in mind we may study briefly the coal reserves of the earth. Of the known supplies North America is said to contain about 67 per cent of the total, Asia about 18 per cent, Europe about 11 per cent, and Oceania about 2 per cent. Africa and South America contain only unimportant deposits.

ESTIMATED COAL RESOURCES OF THE WORLD

Continent	*Metric Tons*
North America	4,971,500,000
Asia	1,402,993,000
Europe	758,494,000
Australasia	167,600,000
Africa	55,313,000
South America	41,600,000
TOTAL	7,397,500,000

Unfortunately, in making her distribution Nature had no concern about the future political divisions of the world. Due to this lack of foresight some nations have been almost entirely ignored, and in other respects the coal bounties were most unequally distributed. A portion of the huge North American reserve is in Canada and Newfoundland, namely, about 1,215,200 millions of metric tons. But even deducting this amount the United States contains about 52 per cent of the total. The British Empire does not fare as well. Indeed, "the available reserves of coal in Great Britain only amount to about one-fortieth, whilst those of the whole Empire do not amount to more than about one-fourth of the world's estimated total." And it was added by this authority that this is a fact that "ought to be weighed by everyone responsible for the economic development of our national and imperial resources, especially in view of the fact that the United States, whose competition in the immediate future will probably be much more severely felt than ever before, possesses more than half the estimated world's coal, and that also in regard to the two prime considerations of quality and cost of production she probably compares favorably with Great Britain and the Empire."[5]

But other nations also fared badly because of the inequalities of Nature's primordial system of distribution. We have referred already to the case of South America and Africa. In other respects these continents have been unusually blessed with mineral resources, but the shortage of coal will prove to be something of a handicap to their varied industrial development. In Europe, Germany with about 416,000 millions of tons is well supplied, and Great Britain with 186,000 millions of tons has no present complaint. But France with only 17,000 millions of tons has not fared as well, nor has Belgium with only 10,000 millions of tons, and Spain was even more poorly supplied with only 8,600 millions of tons. European Russia probably contains 59,000 millions of tons and Asiatic Russia about 171,000 millions. With an enormous population to care for industrially, India contains only about 77,000 millions of tons.

DISTRIBUTION OF KINDS OF COAL

About 52 per cent of the total world's coal supply is bituminous, about 7 per cent is anthracite, and the remaining 41 per cent is made up of the sub-bituminous varieties. The anthracite is even more unequally distributed than the bituminous. In fact, no more than six countries have important supplies. By far the greatest resource is in China, which is estimated to contain more than 380,000 millions of tons out of the world total of 486,000 millions. The anthracite reserves of the United States amount to about 17,000 millions of tons, and of the United Kingdom about 11,000 millions.

COAL RESOURCES OF THE UNITED STATES

The United States has the advantage not only of a large coal supply, but of a distribution of the resource which makes consumption possible over a large area. The great industrial centers have grown up either in the midst of the coal areas, or near the edge of the fields. A great abundance of cheap fuel is thus available for the manufacturing centers. It is fortunate, also, that because of the cheap and convenient transportation of the Great Lakes, coal and iron can be brought together most economically.

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[5] *Ibid.*, p. 10.

There are six producing areas in this country: (*a*) the Appalachian, which extends in a broad belt from southwestern New York to northern Alabama, covering about 66,000 square miles; (*b*) the central coal fields covering about 48,000 square miles in Illinois, Indiana, and Kentucky; (*c*) the Northern field, which includes a relatively small area in Michigan; (*d*) the Western field, extending with slight interruptions from central Iowa to Texas, covering about 98,000 square miles; (*e*) the Rocky Mountain area, with deposits scattered in many places; and (*f*) the Pacific fields with scattered deposits in California, Washington, and Oregon.

Although large quantities of anthracite are produced every year, by far the greater part of the nation's annual production is bituminous. Anthracite occurs chiefly in a few counties in northeastern Pennsylvania. Nearly 60 per cent of the bituminous coal production is in the Appalachian region.

PRODUCTION OF COAL IN THE UNITED STATES

Only small quantities of coal were produced in this country before 1850. In fact, the output in that year amounted to only about 7,000,000 tons. The period of rapid growth of the coal business has been contemporary with the era of great business expansion which began about 1880. From that date to 1920 the railway mileage of the United States increased about two and one-half times, the value of manufactures increased more than tenfold, and the use of primary horse power in industry between nine- and tenfold. These developments largely explain the growth of demand for coal. From an output of about 71,000,000 tons in 1880, production has risen rapidly to 157,000,000 tons in 1890, to 269,000,000 tons in 1900, and to 663,000,000 tons in 1926.

THE COAL TRADE OF THE WORLD

The unequal distribution of coal over the world is one reason for the development of the international coal trade, but not the only cause. A considerable export arises from the need of supplying ships engaged in ocean commerce. Moreover, coal may be carried as ballast, particularly in the case of those nations which export chiefly goods which have a high value in small bulk, and have no heavy raw materials to balance the cargo.

A considerable export from various places in the world grows out of the need of supplying fuel to ocean commerce. On the long voyages it is not economical for the ship to use valuable cargo space in the carriage of coal, particularly since international commerce has gradually built up an extensive system of coaling stations along the routes of travel. Coal is delivered to these points from convenient sources. The stations are usually equipped with modern devices for loading and unloading, and the coaling of the vessel is done as conveniently as in the home port.

Coaling stations are frequently located at places where the lines of commerce converge, as for example, at the passage through Suez. Port Said and Aden are important stations along this route, and farther east, Gibraltar and Algiers perform a similar function. A number of lines radiate from various places in the Far East, as with Colombo, whence traffic moves around south Australia. Singapore is an important concentration point, and this applies also to Hongkong, Shanghai and Yokohama. Ocean vessels, like locomotives, must be supplied with fuel, unless they are moved by wind power, and the coaling of ships which come to the home port is an important branch of the coal trade, if not a kind of export.

Great Britain was one of the pioneers in the supply of the export and bunker trade. She enjoyed a great advantage in this business partly because she drew commerce from all parts of the world, and partly because of the location of coal deposits near a number of her ports. Britain has carried on an export trade in coal for more than three hundred years. As early as 1602 Newcastle sent out 190,000 tons, and in 1750 Newcastle and Sunderland together exported 1,193,000 tons. In 1875 the export and bunker trade of the United Kingdom amounted to 14,733,000 tons, and it rose steadily from this amount to 94,432,000 in 1913. The coal troubles of this country since the close of the War, and the readjustments of coal production in western Europe, have caused a decline in this business; but in all probability Britain will regain her preëminence in the industry.

Coal from various sources in the United Kingdom is exported to many parts of the world. For many years the Mediterranean countries—Italy, Greece, Egypt, and portions of Spain and North Africa—have looked to the United Kingdom as a source of supply. Only small quantities of coal are produced in Scandinavia; hence Norway, Sweden, and Denmark also take coal from British mines. Belgium, the Netherlands, and France, to a considerable extent, have imported British coal, and the last-named country, notwithstanding the shifts of dominion brought about by the War, will still be an importer. The delivery of reparation coal from Germany, particularly to France and Belgium, has interfered somewhat with the British export business, and at the present time, the severe competition of German producers in other markets is taking away some trade.

For a number of years the United States had participated to some extent in the international coal trade, although our exports are small in proportion to our total production. At times Britain sends out from 25 to 30 per cent of her annual production, while the exports of the United States are rarely more than 5 or 6 per cent. The American export trade has shown a moderate increase, from an annual average of about 7,750,000 tons during the five years ending with 1905 to an average of 28,870,000 during the five years ending with 1926. In the last-named year we exported 35,091,000 tons of coal valued at $196,905,000. A considerable portion of this foreign trade is in anthracite which goes chiefly to Canada, and that country also consumes our bituminous coal.

American exports will probably experience a moderate growth, as has been the case in the past; but the relatively high cost of delivering coal to the export points, and the distance from the great consuming markets, militate against a marked development of this branch of trade. The South American countries which might normally look to the United States as a source of supply are small consumers, and at times, American traders encounter competition with British coal carried as ballast.

PROBLEMS OF THE COAL INDUSTRY

Solution of the technical problems connected with the industry seems to be only a minor difficulty compared with other troubles which perennially beset the coal business. The great problems, including those related to labor, grow out of the competitive conditions in which the industry is immersed.

In all the great mining countries there is probably an excess of producing capacity, and this means, among other things, too many workers depending on this industry for an income. This is certainly the case with the United States. According to the report of our Geological Survey in 1924, the capacity of the mines of the United States with the present labor force, assuming 308 working days a year, was 871,000,000 tons, which was about 80 per cent in excess of actual consumption that year. The average number of working days was only 171. The coal miner, of course, complains about the uncertainties of employment and urges that his wages should cover an insurance for the risk of being out of work. He probably observes the profits which the low-cost companies make, and sees no reason why the industry should not support a higher wage level. On the other hand, the operator encounters competitive conditions which are beyond his control. For many producers, a rise of price does not bring relief because it only stimulates production from idle mines, and before long the market is again oversupplied. This compels some operators to close their works and throws men out of employment.

A part of this difficulty is inherent in the nature of the natural resources. Some seams of coal are thick, others are thin. Some mines have the advantage of a near-by market, others are too distant to sell their product unless the price is high. Thus, operators exist under a great diversity of producing and market conditions. The low-cost producer can usually make a profit;

producers in the middle ranges sometimes succeed and sometimes fail; while the high-cost producers can expect a profit only when demand is exceedingly good, and prices unusually high. It might be said in passing that the coal industry is not an exception to the rule, for this condition prevails in every kind of industry, including manufacturers and commerce. If a distinction can be made between the coal industry and all others, it lies in the fact that coal enters into more general consumption, that the prosperity of industry is absolutely dependent upon it, and that the comfort of the people requires a steady supply.

These same difficulties exist in other coal-producing countries, and in the case of England at least, there is the added risk of the foreign market, since a considerable per cent of her coal is destined for foreign sale. The solution of the British problem has been complicated by the intervention of the government in the form of a bounty, which was professedly a makeshift. The tardy introduction of mechanical devices, and the traditions of both miners and operators delay the solution of the problem. As in America, many operators cannot command the capital to put their industries on a more effective basis.

NATIONALIZATION OF COAL RESOURCES

In recent years, both in the United States and in England, there has been a periodic demand for the nationalization of coal resources. A part of this demand originates with certain groups who would like to nationalize everything; but, in addition, there are a certain number of people who believe that the coal industry is a kind of public utility, and that the numerous problems cannot be solved while the industry remains under the competitive system. The idea, which has been growing in vogue since the War, that power can be most effectively delivered from central power stations located on the coal fields, adds something to the movement in favor of nationalization; and the conservatists, who detest waste, and who look with fear upon the growing consumption of coal as an indication of future exhaustion, add their complaint to that of the others.

A most scathing indictment of the coal industry is contained in the following statement: The story of coal is

> a story of waste, all the way from the face of the mine working to the smoke-stacks of the boiler plant—waste of a natural resource, waste of human endeavor, waste of capital, waste of transportation capacity, and waste of energy—and none of these have we enough, much less to spare. [And further:] Of the average ton of coal exploited in this country, 600 pounds are lost in mining, 126 pounds are consumed between the underground working and the boiler room, 446 pounds are lost in gases going up the stack, 102 pounds are lost by radiation and in the ashpit, 650 pounds are lost in converting heat energy into mechanical energy and only 76 pounds are left for application to useful work. The average small plant or locomotive in use today makes use of a small percentage of the heat units shoveled into it. When it is recalled that 300 pounds of coal, even under the wasteful and inefficient manner in which it is now utilized, represents the labor equivalent of one man for one year, it is readily seen how significant the conserving of our fuel energy, and thereby our human energy, becomes.[6]

Rhetorical indictments, such as those given in the quotation above, must be taken *cum grano salis*. In the first place, an analysis of the chart which accompanies this statement reveals the fact that 1,198 pounds out of 2,000 are consumption wastes. For example, 446 pounds go up the stack in smoke and gas, and an additional 650 pounds are acknowledged to be non-recoverable in the present state of our mechanical knowledge, because this amount is lost in converting the heat of combustion into useful work. Only 713 pounds are production losses, and not even all this is recoverable without other expenditure. The roof of the mine, for example, must be braced in some way, and if coal is not used for this purpose, some other material must be employed, and this means a cost.

In short, the saving of waste is not a gratuity which proceeds from any form of organization, or from government ownership and operation. Somewhere along the line from research to material an expenditure of some kind must be made to save waste, and the real question is whether the saved income more than offsets the cost involved in making the saving. The whole question of the effectiveness of management is involved in the matter of nationalization, and there is very little convincing proof that management would be any better under nationalized organization than under the kind that exists today. And this says nothing about the troubles of marketing. One might multiply words expounding the enormous waste of the valuable chemicals which are lost through individual and factory consumption of coal, and in praise of the economies by operation from central power plants. But it would be difficult to find buyers for the tons of tar, ammonia liquor, and sulphate, and the millions of pounds of aromatic hydrocarbons (benzene, toluene, anthracene, naphthalene, etc.) that would arise as by-products of such plants, unless they were disposed of by an equally wasteful diversification of consumption.

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[6] Gilbert and Pogue, *Power Resources of the United States*, p. 80.

Moreover, the fear about the exhaustion of coal resources is unfounded. While it is true that the cream of the resource is exploited first, and that production proceeds thence to lower-grade deposits, the mineral industries are constantly revealing new methods of operation which lower cost and which make available poorer grades of natural materials. A small rise of price often supplies the stimulus for further experiment and discovery. Moreover, as we have already seen, there are many substitutes for coal, and we have every reason to believe that the progress of science will still further release us from dependence on that substance.

All this is not intended as an argument that the coal industry does not stand in need of improvement. The greatest evils of this industry are the irregularity and uncertainty of operation. When these problems are solved most of the evils which now trouble both miners and operators will largely disappear. It is these features which lead to only partial employment—which is one of the chief troubles of the miners—and to the unwillingness to invest sufficient capital to put the business on the most effective basis, a frequent complaint of the operators. And it ought to be added that the problems of uncertainty and irregularity are not easy to solve. The wide distribution of coal resources in the United States, and the ease with which a company with a little capital can engage in the mining business, bring in the occasional producers, the wildcat and snowbird miners, who can prosper when times are good, and who are usually a source of trouble.

BY-PRODUCTS OF THE COAL INDUSTRY

It is our intention to discuss the question of by-products in a later section, but it might be said in this place that in recent years a number of related lines have developed in connection with the coal industry. The ramifications of these by-products are numerous. Coke, for example, is sold to pig-iron manufacturers, and to producers of copper and lead, to say nothing of other uses in the metal industries. It is also sold for chemical use, and thus enters into the manufacture of electrodes, calcium carbide and other products. It is used as a boiler fuel, in the manufacture of briquettes, and as a road or railway filler. Tar has even more extensive uses; and gas, light oils, and ammonia also enter into many kinds of manufactures.

FOREIGN CONTROL

Investments abroad, or other forms of control, are probably not as extensive in coal resources as in iron. For one thing, the coal reserves are much greater and more widely distributed than in the case with iron. Nevertheless, some capital has been invested in coal properties by the business organizations of several of the nations. Occasionally, the need of supplying coal to coaling stations is the reason for such investment. Japan is more in need of adequate outside supplies than any of the great nations and this is one reason for her investments in China. Several British companies also control coal properties in China and Siberia.

QUESTIONS

1. Name and discuss the contributions which the use of mechanical power has made to industrial progress.
2. Do resources of coal within the border of a nation increase the competitive strength of the nation? Why?
3. Wherein is the "strategy" in the control of coal resources?

4. What do you understand by the expression "key materials"? Give illustrations.

5. The history of "iron and coal are not only parallel but often interlocking." Give illustrations.

6. Where does a man get the first idea that leads to an invention? Where, for example, did Murdoch get the idea that led to the production of illuminating gas?

7. Which countries are the largest producers of coal? Account for their rank as producers.

8. Can you explain why Asia, which contains about 60 per cent of the population of the world, consumes only about 7 per cent of the coal?

9. Is there any basis for alarm concerning the future of the world coal supply?

10. Are there adequate substitutes for coal in its important uses?

11. In what respects are present methods of production and consumption of coal wasteful? How much of this waste can be prevented?

12. Give some idea of the distribution of the world's coal resources?

13. Does the existence of a great part of the world supply in North America give this continent a present and a future advantage?

14. Give an outline of the leading problems of the coal industry. What remedies would you suggest?

15. How are the difficulties of the coal industry affected by the great range in costs under which coal is produced?

16. What can be said for and against the nationalization of coal mines?

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CHAPTER VIII

PETROLEUM AND NATURAL GAS

Various preparations of petroleum were articles of commerce in the United States before 1820. Zadok Cramer, an author of one of the numerous guide books for immigrants into the New West, observed philosophically in 1817 that "it is a wise plan of nature to generally place an antidote where she has planted a poison." He referred to the use of petroleum as a medicament, for it was used as a nostrum for practically all the ills to which the pioneers were heir. It was found floating on many ponds and was easily collected by drawing a blanket over the surface. It was sold as "Seneca," or "American" or "Rock-oil," and was recommended particularly for rheumatism.

Some twenty years later Caleb Atwater, a western historian of some note, stated that the sale of petroleum afforded a considerable profit, and that it had begun to be used in lamps for workshops and factories. He ventured the prophecy that if it should "fall into the hands of some 'water-doctor,' or some swami, a large fortune could be made by the sale of it."[1] If one would tolerate a little freedom in the definition of "swami," he would be compelled to admit that Atwater's prophecy was on the eve of fulfillment in 1865. But even at that date no one realized the enormous proportions to which the petroleum industry was destined to grow in another thirty years. It was, of course, impossible to foresee the vast number of uses to which petroleum and its by-products are put, and to guess that it was shortly to become a great stake in the strategy of nations and of great capitalists.

During its rise as a commercial product petroleum has been successively a medicine, an illuminant, and a fuel oil, and now, in one form or another, it serves all three of these purposes, and a great many more. The fuel use is now one of the most important, and in some respects petroleum serves this purpose much better than coal for it is easier to transport and store; it possesses greater calorific power, and it undergoes more complete combustion.

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[1] I. Lippincott, *Internal Trade of the United States*, p. 119.

HISTORY OF PETROLEUM

For ages petroleum has been used for one purpose or another; but the history of this product prior to 1860 is of no significance for modern industry because it neither called attention to possible industrial uses, nor contributed knowledge of methods of making it available for general industrial consumption. The modern industry began at the bottom and worked out its own technique of mining, transporting, distilling, and marketing. This is one of several very important illustrations of an entirely new industry which sprang into existence subsequent to 1860 without prior help, or without even a suggestion of the uses to which the material could be put.

The situation was ripe for a change at least as early as 1850. The consuming world was rapidly exhausting the available raw materials out of which illuminants could be manufactured cheaply. There was a great need for some substance to take the place of beeswax and tallow candles and the greasy whale-oil lamps. The decline of the whale-oil business, due to the growing scarcity of these sea creatures, threatened to bring that branch of the oil industry to an early close. Lamps using animal oils had never been satisfactory and candles were an expensive substitute. Thus there was an imperative need of some new illuminating substance which could be manufactured cheaply on a large scale.

One of the first steps which inaugurated the change from animal raw materials to mineral oils as a source of illuminants was the production of oil from bituminous coal shale. The first patent for refining coal oil was granted to James Young of Manchester, England, in 1850. The same process was patented in the United States in 1852. Considering the fact that the industry was new, very rapid progress was made during the next six or seven years. In 1859 upwards of sixty establishments were engaged in the manufacture of oil from shales.

This industry, however, was short-lived because of the subsequent introduction of methods for producing illuminating oil from crude petroleum. As a matter of fact, in 1854 two New York lawyers, Jonathan Eveleth and George H. Bissell, conceived the idea of obtaining an illuminating product from the crude material. Although the enterprise was not successful the information the organizers received about samples of this product submitted to Professor Benjamin Silliman, a Yale chemist, was of value to the new industry. In substance, Silliman advised that the samples produced good illuminating and lubricating products.

Legal talent seems to have played a rôle of considerable importance in the early promotion of the oil industry. At any rate, James Townsend, another New York lawyer, secured the assistance of E. L. Drake, who had formerly been a conductor on the New York and New Haven Railroad. Drake did some prospecting, and eventually sank a well near Titusville in Crawford County in northwestern Pennsylvania. The oil did not rise to the surface and it was necessary to use a pump, but Drake's work revealed the fact that petroleum was easily accessible. Subsequently, flowing wells were discovered. Drake's success proved a great stimulus to the imagination of the time, and hundreds of people who saw immediate profits in the production of oil flocked to the region. Thereupon the industry experienced the first of what in subsequent years proved to be a recurring phenomenon, namely, overproduction.

Crude petroleum is the source of a great many products ranging from those of highly volatile character to solid material. The earliest step in the separation of the crude oil into its various products is fractional distillation. The method of distillation depends on the product desired. Since there are many kinds of crude oil the process is frequently adapted to the kind of material which comes into the refinery. Needless to say, these methods have been the result of years of experience in testing and refining. Organization and economy have always been guiding principles in the industry. The use of hydrostatic pressure to force more oil from the wells than can be obtained by the ordinary process, the development of the cracking process, which is a method of decomposing hydrocarbons by heating petroleum to a temperature above the normal boiling point of certain of the constituent parts, and the production of casing-head gasoline from certain kinds of natural gas are some of the most recent methods of securing greater economy. One of the great features of the industry has been the development of hundreds of by-products which serve as many uses of man.

Ewing Galloway

Signal Hill, near Long Beach, California, one of the country's richest oil fields

IMPORTANCE OF PETROLEUM

There is room for difference of opinion in regard to the importance of petroleum in modern life. In this connection Edwin C. Eckel makes the following comment:

> The production and utilization of petroleum have been kept before the public mind so steadily, for one cause or another, that we are likely to

> overestimate both the present industrial importance of the mineral oil industry, and the probabilities as to its continued growth and increase of supply. As regards the first point, it is still safe to say that if the entire petroleum supply of the world were to be cut off completely today, it would mean that we would have to increase our coal mining some eight per cent at the most to replace the missing product in technical efficiency. What would actually happen in such a case would be that the coal output would increase only four or five per cent, and that the balance of the deficit would be made up by the distillation of shales to get not petroleum but its derivatives.[2]

Now it is true that we shall have to give up petroleum at no very distant future, and that there are enormous stores of oil-bearing shales not only in the United States but in other parts of the world which can supply a great many of the products which now come from petroleum. It is true, also, as with coal, that there are a number of prospective substitutes for mineral oils as a source of light and power, and other substitutes are in sight, but not yet developed, largely because the cheap supply of petroleum discourages use, if not invention and discovery. The one thing which a progressive community needs to stimulate new activity is the threat of shortage, or the fear of inconvenience. With respect to petroleum, this threat is not yet obvious enough in the United States to produce these stimulating results. But there is some comfort in the fact that there are a number of other substances upon which we can rely when petroleum is no more, and that with the present high state of development in the mechanical and chemical industries the provision of substitutes on an increasing scale will be no difficult matter.

But there is another side to the question. The reorganization of social life on the basis of some other power substance, when that time comes, will entail a great social and individual cost. Someone must pay the expense of making the change. In a former chapter we have had something to say about the intricate industrial organization in which we live, including the interdependence of one activity on numerous others. Numerous strands of forces bind this organization together into a working economy. Petroleum and its products are interwoven to such an extent in our daily lives, and in our industries, that a change cannot be made without enormous loss and inconvenience. For one thing, great amounts of capital have been invested directly in the petroleum industry, and very considerable sums are in industries which are somehow related to the production of materials which supply this industry, including the manufacture of all forms of iron and steel, and in goodwill which is now attached to the various articles. This capital is highly specialized, which means that it cannot be used for any other kind of production, or at best, it cannot be thus employed without great expense for reorganization and readjustment. Moreover, when the time comes for the abandonment of the large-scale use of petroleum and its products we shall have to pay a higher price for the substitutes, at least for some years until the new industries are perfected. This means a higher cost for motor oil, among other things. This will bring about a restricted use and a curtailment of the prosperity of those particular industries which are now related to petroleum either as producers or consumers. Thus, the important fact is not that we cannot find substitutes, but that we are now living on a low-cost basis with respect to all those things derived from petroleum, and that the next move is to a higher cost level with all that means for social life. Or, in other words, we are now living on one of the original bounties of nature, but subsequently more human effort will be required to produce the things of which Nature is now a large contributor.

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[2] E. C. Eckel, *Coal, Iron and War,* p. 117.

At present the purely commercial and military reasons add to the importance of petroleum products, and this explains why some nations are now engaged in keen rivalry in securing claims to future supplies. Thus it has been said of this product: "More easily transportable than coal, and yielding refined products whose explosive action in internal-combustion engines furnishes greater power in proportion to weight than was once deemed possible, petroleum and its products, apart from their immense direct economic importance may, in the automobile, the submarine, and the airplane, and through numerous other applications, control strategically, from a nationalistic standpoint the more inert foundations of civilization."[3] The use of petroleum as a fuel in driving commercial vessels is now of great importance, and thus the nations which have greater access to supplies, while they last, gain something in international competition.

MEANS OF TRANSPORTATION

One of the first problems of the new petroleum industry in 1860 was to find a satisfactory means for the transportation of the product. In the earliest days, oil was put in barrels and carried by wagon or boat to the nearest railroad. But the penetrating feature of crude petroleum made it almost impossible to manufacture barrels which would retain the substance. This problem was not solved even when the barrels were coated with hot glue.

Railroad transportation encountered similar difficulties. For a few years oil was transported in wooden tanks or tubs placed at each end of a box car; thus equipped a car could transport from 2,000 to 4,000 gallons. The many difficulties which the early shippers encountered may have suggested the use of pipeline transportation. But this method of conveying liquid was not new because it had been extensively employed a few years before by the salt manufacturers of the Mississippi Valley in transporting brine from salt springs to a supply of wood. This prior use of wooden pipe lines may have given the producers of oil their earliest cue. But, at that, the shipment of oil by pipe line brought its own series of problems. It was necessary to devise means of crossing streams and mountains, to discover the proper location for pumping stations, and particularly, to decide upon methods of tightening joints to prevent leakage, due to the great pressure of the moving oil in the pipe system.

The first pipe lines were constructed to connect some producing area with a river or railroad, but eventually a system of trunk and feeder lines was developed. In 1926 there were upwards of 90,000 miles of line in the United States, divided about equally between trunk and gathering lines. Other countries which rely on long-distance land carriage have also employed the same method of transportation, although not as extensively as the United States.

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[3] J. E. Spurr, ed., *Political and Commercial Geology and the World's Mineral Resources*, p. 1.

PRESENT PRODUCTION OF PETROLEUM

The active development of petroleum resources is now in progress in more than twenty countries, but only about five of these are important producers. Since the beginning of the industry from 1860 to 1925 the United States produced about 64 per cent of the world supply. In some respects our preeminence in this regard might be looked upon with national pride. It is certainly true that the development of petroleum has exerted an enormous effect on the progress of national prosperity; but, as a matter of fact, we have secured our position as a producer at the expense of rapid exhaustion of a resource which cannot be replaced. During this period Russia has been the second largest producer and Mexico has ranked third, although that country did not enter the field until about 1900. One remarkable aspect of petroleum history is that the United States is the only great industrial nation which has produced large quantities of petroleum. Through these years the total output of England, France, and Germany was only 19,000,000 barrels, as compared with more than 7,000,000,000 barrels in the United States. As a matter of fact, with the exception of the United States and Russia, the future petroleum supply is in the territory of the smaller and weaker nations. The total world output of petroleum from 1857 to 1924 inclusive is shown in the table given on the next page.[4]

PETROLEUM RESOURCES OF THE WORLD

A very large limit of tolerance must be permitted in estimating the present underground supply of petroleum. The fact that those who are skilled in the art of making estimates are continually changing their figures in the light of new information is enough to convince us that their estimates are not final.

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[4] *Mineral Resources of the United States,* 1924, Part II, p. 416.

World's Production of Crude Petroleum, 1857-1924

Country	*Barrels of 42 gallons each*
United States	7,905,929,000
Russia	2,053,183,000
Mexico	1,194,991,000
Dutch East Indies	294,030,000
Roumania	207,842,000
Poland (Galicia)	190,633,000
India	157,546,000
Persia	147,522,000
Peru	52,321,000
Japan and Taiwan	49,496,000
Canada	25,561,000
Trinidad	23,264,000
Argentine	20,421,000
Venezuela	18,212,000
Germany	16,739,000
Savawak	16,505,000
Egypt	11,758,000
France	2,858,000
Colombia	1,192,000
Italy	1,186,000
Czechoslovakia	481,000
Algeria	70,000
England	12,000
All other countries	789,000
Total	12,392,541,000

The resources of the United States are by no means on the eve of immediate exhaustion, although production has been rising at an alarming rate. It is maintained that only from 60 to 65 per cent of our original supply remains, and that this is not large when we take into account the annual production which was about 760,000,000 barrels in 1926. If our remaining reserves are only 8,000,000,000 barrels it is evident that our supply will not last long at our present rate of increase of consumption.

Although we have been more lavish with our resources than any other country, the underground stores of petroleum of the United States are still greater than those of any other nation.

Russia contains the next largest amount. The southeastern portion of this country, together with southwestern Siberia and the Caucasus may contain about 6,000,000,000 barrels. Persia and Mesopotamia rank next with nearly the same amount. The northern portion of South America may contain about 5,000,000,000; Mexico about 4,500,000,000; and the southern portion of South America about 3,500,000,000. The East Indies, China, Japan and Formosa, and Roumania and Galicia each contain a little more than 1,000,000,000 barrels. Smaller reserves exist in Canada, India, Algeria, and Egypt. The statements above name the regions in their order of importance as prospective producers.

Although there is a considerable difference of opinion as to the total remaining reserves, all are agreed that the world resources are very small considering the rapidly increasing rate of consumption; in other words, the petroleum age is merely a passing phenomenon as industrial epochs go. But at least, consumers on the western hemisphere have this much consolation, namely, that the Americas possess between one-third and one-half of the remaining supply. The Mexican reserves, and those of the northern portion of South America, are immediately available. Even now, Venezuela is being actively surveyed by a number of great companies, and the output of the country has begun to increase. Colombia will probably have the same experience within the next few years. The resources of the southern part of South America are not too far distant to afford considerable relief when additional supplies are needed.

Nature was most bountiful with the sparsely settled portions of the world. If the Far East were as wealthy and as highly industrialized as the United States or western Europe the limited petroleum resources which nature has allotted to this area would be a serious embarrassment. According to the present system of estimating, India, with its enormous population, contains less than 1,000,000,000 barrels. A similar remark applies to China. While that country is remarkably well provided with high-grade coal, the petroleum reserves are very small in proportion to future needs. Japan, likewise, which is straining every nerve to attain to a high stage of industrial development, does not possess adequate reserves. The quest for oil in the islands has been as intense as in any part of the world, but without important results. The search in Formosa has been equally disappointing. In fact, at the present time, the daily product of the United States exceeds the annual output of Japan. To give the actual figures for 1926, only 1,900,000 barrels were produced in Japan during that year, while the output of the United States was about 766,000,000 barrels.

The middle areas, between the populous regions of eastern and southern Asia and those of western Europe, are most fortunate in their possession of petroleum. The areas, including Persia, Mesopotamia, and southeastern Russia, have already become the battleground for international political strategy, and for that of competing groups of great oil companies. In a number of cases the private organizations are supported by their governments—a situation which is in marked contrast with that of the United States.

THE STRUGGLE FOR PETROLEUM

No one strives for the free goods of Nature; but when a material becomes an object of growing consumption, when the welfare of nations depends largely upon it, and when the supply becomes limited with respect to future demands, commercial rivalry is keyed to its highest pitch. This is the reason for the present struggle for control over the sources of petroleum.

This material has attracted a greater foreign investment than has any other resource. The exploiting enterprise has been carried on largely by the great oil companies, although in some cases financial groups which are not immediately interested in producing and refining have invested funds in this way. In many cases it is impossible to locate the actual control because it is exercised through the interlocking interests of a number of large companies and it is frequently complicated by the intervention of governments in one way or another, as through partial ownership, financial aid, or direct encouragement to the companies which engage in the business of exploring and producing. The intricacies of foreign diplomacy add another interesting element to the situation.

Development of resources in the United States is chiefly in the hands of American companies, although some British and Dutch capital is invested in oil-producing properties. Commercial control of petroleum in Mexico is largely in the hands of American capital, but British and Dutch interests are involved here also. The resources of the Dutch East Indies are controlled nominally by the Dutch, but British capital is also involved through stock ownership and through minority voting power on boards of directors. British capital is in control in India, Japanese in Japan and Formosa, British in Persia, British, and Dutch in Roumania, and British in Egypt, to name only a few of the cases of control. During the last few years American interest has been spreading in Venezuela and in Colombia. There are indications, also, that American capital is becoming involved in Russian concessions, possibly in some relation with British and Dutch interests.

The actual financial contact with a foreign resource may be made in a number of ways. Control, which is usually obtained by private capital—although there are some exceptions—"is determined in the main through direct ownership of lands, leases and concessions, or by the control through holding corporations of subsidiary companies holding fee, leases, mineral rights of concessions of petroleum lands." [5]

DEVELOPMENT OF PETROLEUM RESOURCES OF THE UNITED STATES

The chief causes for the early development of the petroleum industry from 1860 to 1900 were the demands for illuminating and lubricating oils. Consumption of these products supported a large industry. Indeed, the output of petroleum increased from 26,200,000 barrels in 1880 to 63,600,000 barrels in 1900. But there was a considerable slowing up in the rate of increase during the decade from 1890 to 1900, due to the growing competition of the public utilities which supplied gas and electricity.

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[5] Spurr, ed., *op. cit.*, p. 11.

The manufacture of automobiles was put on a commercial basis about 1900, and since that date the demand for motor fuel has been the mainstay of the petroleum refiners; since 1910 there has been a rapid growth in the use of petroleum products as fuels in domestic gas burners, and in locomotives and steamships. Refiners have received a twofold advantage from these new developments, for petroleum supplies not only motor oil and fuel, but the lubricating materials.

The motor industry entered its period of most rapid expansion shortly after 1910, and the refiners have been the beneficiaries of this enormous development. In 1913, for example, the automobile registrations in the United States numbered only 1,258,000; the number in 1926 was 22,001,000. The large increase in consumption by the new automobile users, together with the new demands for fuel, have made necessary much larger production than in any other period of our history. Responding to the new demands the production of crude has increased from 209,500,000 barrels in 1910 to 766,000,000 barrels in 1926.

Petroleum sources are widely distributed over the United States, but at the present time more than 85 per cent of the domestic supply is produced in the mid-continent and California fields. At one time or another some of the older sources have yielded large amounts of petroleum. This was notably the case with the Appalachian field which has now dropped to the fifth place. In the table given below we present the total production of each field since 1857, together with the output for 1926.

PRODUCTION OF CRUDE OIL BY REGIONS
(*barrels of 42 gallons*)

Region	Production in 1926	Production since 1857
Appalachian	28,617,000	1,455,437,000
Lima-Indiana	2,041,000	468,596,000
Illinois	8,420,000	377,303,000
Mid-continent	422,590,000	3,755,200,000
Gulf	44,074,000	570,024,000
Rocky Mountain	36,547,000	295,052,000
California	224,215,000	2,514,564,000
TOTAL	766,504,000	9,436,176,000

The Appalachian and the Lima-Indiana fields are largely exhausted, only about 24 per cent of the original supply remaining in the first and probably less than 10 per cent in the second. The mid-continent field is in somewhat better condition although the percentage varies from place to place. The Kansas-Oklahoma area may be less than 35 per cent exhausted. In the case of California, possibly more than 30 per cent of the original supply has been removed.

In 1926 production was reported from seventeen states. California ranked first, Oklahoma second, Texas third, Arkansas fourth, and Kansas fifth.

CONSUMPTION OF PETROLEUM PRODUCTS IN EUROPE

Europe is the second largest market in the world for petroleum and its products, but, at that, the consumption is far below that of the United States. In this country, in 1925, the per capita consumption was 6.17 barrels; in Europe it amounted to 0.29 barrel. To state this fact in other words: "Europe, with a population of about 475,000,000—more than four and a half times as large as that of the United States, consumed about one-fifth the amount of oil."[6] One important reason for this condition is found in the use of motor vehicles. In this country in 1925 there was about one such vehicle for every 6 persons, whereas in Europe there was one for every 177 persons. The total consumption of oil in Europe in this year amounted to about 142,000,000 barrels. Production—chiefly in Russia, Roumania, and Poland—amounted to about one-half this amount. Large amounts of petroleum and its manufactured products, including gasoline and lubricating oils, were imported from the United States. The refining industry is apparently expanding in the United Kingdom, supplied with crude oil partly from the United States and from the Persian fields, supplemented, in the last few years, by shipments from Russia. A number of the European countries are making strenuous efforts to be relieved of some of their dependence on the United States.

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[6] *Europa,* 1928, p. 102.

QUEST FOR SYNTHETIC SUBSTITUTES

Both the desire to be less dependent on America, and the high price of fuel oils in Europe, are stimulating the search for substitutes. "There is always talk of the manufacture of synthetic oil, but it will be many years before Europe can displace any appreciable proportion of its oil imports by the domestic manufacture of oil products. The Bergius process of hydrogenation of coal (distilling under pressure with hydrogen) has, on the recent admission of the inventor, not yet passed into the commercial stage. Some progress has been made, however, with the distillation of brown coal in Germany. The German Dye Trust has planned the erection of a large plant for coal distillation in the center of the lignite fields, with an output of 250,000 to 300,000 tons of synthetic petrol a year. The fact that the Dye Trust has formed the Deutsche Gasolin A. G. in coöperation with the Royal Dutch-Shell and Standard Oil groups (which have each a 25 per cent interest) to develop this synthetic petrol enterprise, does not support the idea of Europe shaking off its dependence on foreign oil companies." [7]

OVERPRODUCTION AND WASTE

It is something of an anomaly that the United States, which is not many years away from exhaustion with respect to petroleum resources, is periodically in the throes of overproduction. One of the worst of these periods in our history began early in 1927. This situation is due largely to conditions under which petroleum is exploited.

Under the competitive régime a leaseholder, or operator, does not control all the land surface above the pool. Or, as some would say, he owns a surface or proprietary unit, but not the geological unit, which is the pool. In fact, the owner may possess only a few acres, or even less, and the remainder is divided among a number of other competing owners. Thus, there is no relation between the surface property rights and the claim to oil which lies in the earth. Exploitation is a matter of "first come, first served"; for the operator who taps first, and pursues his work most diligently often gets the lion's share. When a new pool is discovered it becomes at once the interest of all claimants to land surface to work as hard and as fast as they can. They must do this for their own protection, otherwise their neighbors will obtain more than their share.

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[7] *Ibid.*, p. 105.

In the face of the steadily, and rapidly, increasing demand one would expect the trend of prices to show some stability, possibly with an upward trend. Instead, the price history of the industry reveals an endless repetition of advances followed by declines often to the point of depression. For example, the average annual price of five principal grades of crude was $3.44 a barrel in 1920; it dropped to $1.71 in 1923, rose to $2.03 in 1926, and under the great overproduction of 1927 it dropped to about $1.04 a barrel. This last-named price is amazingly low in view of the enormous demand of that year. It is not difficult to find the reason. When a large underground source is tapped there is feverish exploitation by those who have surface rights, irrespective of the state of the market. In this struggle for a share of the product "the aim of each producer is to drain the largest possible underground area in the shortest length of time, before the oil is secured by a competitor."[8] Evidently, this system often leads to the production of more oil than the market will absorb at a price which affords even a reasonable profit to all engaged in the business. Operators in the older sources, which are partially exhausted, and where the cost of production is relatively high, find difficulty in competing with producers at the newer sources, and yet, for a time, at least, they must keep their establishmnts in operation, thereby augmenting the glut. This state of affairs often runs along for several years until consumption has caught up with production, when the process is repeated again.

Possibly, in the long run, a less rapid exploitation of the resource would be to the best interest of the community, because a higher price would cause some economy among consumers. But abstinence is the last thing the consumer thinks of when overproduction reduces the price. With petroleum, as with coal, there are wastes of consumption as well as wastes of production, but critics of the industry usually overlook the former.

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[8] G. W. Stocking, *The Oil Industry and the Competitive System,* p. 140.

Overproduction, therefore, is not the only problem of the petroleum industry, because conservation of the resource has now been forced upon us as a critical issue. There is no doubt that the industry is indictable because of its preventable wastes. Some of these are due to competitive drilling, which leads to overproduction and wasteful consumption; there is also the waste of natural gas, which is often regarded as a nuisance and is allowed to escape into the air; considerable waste is occasioned at times by the seepage of water into the wells which may render production not only unprofitable, but impossible. And, finally, waste is sometimes due to the failure of operators to pool their knowledge, which prevents the best technical methods from being employed throughout the industry. But, at that, not all wastes are preventable. In many cases the most efficient operators do the best they can with the knowledge available, and loss occurs even with all this care. With our present knowledge, for example, it is impossible to extract all the petroleum from the earth. In some cases, a surprisingly large amount must be left in the ground. The science of the industry may later reveal a method for making Nature yield a large proportion of her product.

We may take one example. With the exception of a few companies which employ hydrostatic pressure, the industry depends on the natural gas pressure to force the oil to the surface. And "as the pressure is released there is a constant tendency for some of the gas to be dissociated from the oil which tends to remain behind."[9] While the extent of recovery depends on other factors, such as porosity and texture of the sand, and the viscosity of the oil, the operator must depend on gas to lift the oil, and the premature exhaustion of this pressure, due to the sinking of too many badly placed wells, prevents the recovery of a large portion of the natural store. Estimates of this loss range from 40 to 90 per cent. Thus "the problem of maximum production in any given area is largely a problem of efficiency in the utilization of gas pressure."[10] As with everything else, there is a limit beyond which we cannot go in the recovery of waste, but the present system is justly criticized because of its failure to approach this limit. The possible extent of this waste is indicated in the following statement: "Under present practice, from 30 to 90 per cent of the oil is left underground. Then, of the quantity produced, an appreciable percentage is lost by fire, and a significant portion dissipated by seepage and evaporation due to inadequate storage facilities. On the average, therefore, it is safe to say that less than 25 per cent of the petroleum underground reaches the pipe line. If we subtract from this proportion the losses involved in improper and wasteful methods of utilization, the recovery factor becomes perhaps as low as 10 per cent."[11]

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[9] *Ibid.*, p. 142.

Some of the difficulty lies in our laws which have discouraged combination among producers. To the extent that evils arise from wild competition, melioration of these conditions is to be found in better coöperation, and perhaps in combination under some system of federal regulation. One great difficulty with any system of control is the attitude of consumers who are willing to take their chances with the future if only they can be assured a cheap product in the present. And, unfortunately, too many producers wish to work out their own problems without reference to the action of competitors in the trade.

NATURAL GAS

It is impossible to discuss petroleum resources without some reference to natural gas. In some respects the industries are interlocking. Natural gas and petroleum usually occur together, and in many instances, operators exploit both gas and petroleum for industrial purposes. In recent years the so-called "wet gas" has been made to yield a valuable product for fuel purposes. Natural gas is employed in some places for heating, illuminating, and for some industrial purposes. At one time it was a rather important factor in the manufacture of glass, where a clean fuel was desired. It is usually a cheap fuel when it can be employed near the source, but the cost becomes considerable when it is necessary to pipe the gas some distance from the well. The great producing sources are usually too far distant from the possible consuming centers to make possible extensive use for domestic purposes, although natural gas is used in this way to a small extent in some localities. When it is burned under proper conditions it provides an excellent fuel, due to its high calorific value and to the absence of smoke.

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[10] *Ibid.*

[11] Gilbert and Pogue, *America's Power Resources*, p. 107.

That considerable use is made of this product in the United States is shown by the fact that the value of natural gas marketed in 1926 was about $294,000,000, having increased from about $70,700,000 in 1910. In addition large quantities were used by producers. These figures, however, convey no idea about the enormous wastes of natural gas. An investigation of certain wells in Texas in 1919 showed that the daily waste per well ran from a million to one hundred million cubic feet and that some of these wells were uncontrolled from a few weeks to six months. In practically every case petroleum is the object of the operators' enterprise, and even if it were possible to conserve the gas, the problem would be presented to market the enormous quantities that flow from the wells.

HELIUM

Helium owes its growing importance to its possible uses in aëronautics. For such purposes it has two qualities to recommend it, namely, its lightness, for it is only about twice as heavy as hydrogen, and its non-inflammability. While its lifting power is not as great as that of hydrogen it is less dangerous to use. This element has been found in the water of certain mineral springs, and exists in minute quantities in the atmosphere, but it has been recently discovered in commercial quantities mixed with the natural gas of certain wells. As a matter of fact, the natural gas from sources in the Dexter area in Kansas is said to contain so much helium that it is not usable for heating or cooking. In 1927 a helium plant, the second of its kind in the world, was erected at Dexter for the purpose of supplying the United States government with helium for use in lighter-than-air crafts. The other plant, located at Fort Worth, Texas, is operated by the United States government. The possibilities of employing helium for commercial, if not for military, purposes is an added reason for the conservation of natural gas, at least in those areas where considerable quantities of this element are present.

AFTER PETROLEUM WHAT?

This is an interesting question, particularly to automobilists who ought to have some thought about the future of motor and lubricating oils. Prophecy is always dangerous in an age which is making rapid scientific progress. At any time some ingenious pathfinder may blaze an entirely new trail which may reveal some great new source of power. But, at present, we have more certain data upon which to base our guess.

In the first place, there will be some production of petroleum for many years, although the quantity may be small in proportion to the growing needs. Improvements and inventions in refining processes will continue to reveal more economical methods of production. It is possible, also, that a way may be found to reclaim some of the great stores of petroleum which cannot be brought to the surface by any method known at present. Moreover, geologists do not claim to have attained to perfection in the art of locating hidden sources, and this supplies us with another basis for faith and hope. Deeper boring may reveal unknown stores.

But there are other resources, if all the above fail. Even now chemists are searching for synthetic products. Europeans are much more concerned with this problem than we are in the United States. The desire to be independent of this country, the inadequacy of their supply of petroleum, and the high price of imported products, are reasons for their interest in synthetic methods. The Bergius process for the production of crude oil and gasoline has now been "declared to be a practical undertaking." Experiments with lignite seem to be meeting with some success. Some experimenters are working with methods for the carburetion of heavier fuels. Others are trying mixtures of alcohol and gasoline. And still others are working to produce fuel from water gas and the acids of different catalysts.

Moreover, we always have coal to fall back upon. In addition, a number of parts of the world contain great stores of oil-bearing shales from which petroleum oils can be produced. Large quantities of these shales are found in Wyoming, Colorado, Utah, and in other parts of the United States. It is evident, therefore, that we shall have substitutes for petroleum, although the price may be somewhat higher than at present.

QUESTIONS

1. Trace the development of the more important uses of petroleum.
2. Why is petroleum now a great stake in the strategy of nations and of great companies?
3. Why has the petroleum industry grown so rapidly, particularly since it started from almost nothing in 1860?
4. What leading improvements have taken place in the production and refining of petroleum?
5. Estimate the importance of petroleum in modern life.
6. Would the exhaustion of petroleum bring about material changes in industry and social life? Why?
7. Why do not inventors and discoverers develop important substitutes for petroleum?
8. Why are some nations involved in a keen rivalry for control over petroleum resources?
9. To what extent have our great petroleum resources contributed to the development of wealth and well-being in the United States?
10. State the present distribution of the world's petroleum resources.
11. By what methods is control over foreign resources of petroleum obtained?
12. Trace the development of the petroleum industry in the United States.
13. Contrast the conditions of consumption of petroleum in Europe with those in the United States. Account for the differences.
14. Describe the quest for synthetic substitutes. Why has this movement gained greater force in Europe than in the United States?

15. How do you account for the fact that the United States which is not many years away from exhaustion is periodically in the throes of overproduction?

16. Explain how the conditions under which petroleum is exploited lead to periods of overproduction.

17. Should the government control the petroleum resources?

18. Why was the price of petroleum so low in 1927 in the face of an enormous demand? Is the price of anything determined by the demand alone?

19. In what respects is the petroleum industry a wasteful enterprise?

20. After petroleum what? Give your answer.

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CHAPTER IX

COPPER, LEAD, AND ZINC

Copper, lead, and zinc have been used for ages, but because of their peculiar relation to modern industries their development is more a characteristic of this age than of any era which preceded it.

COPPER, LEAD, AND ZINC IN HISTORY

Copper was one of the first of the elements to be obtained in the metallic form. Some authorities contend that its use antedates that of iron, and with good reason, for the early metal-workers probably found the extraction of this metal a much easier and simpler task than was the case with iron. At any rate, copper, either as metal or as alloy, was extensively used in ancient times. Prehistoric remains reveal great quantities of tools, ornaments, weapons, and implements made of this material. Bronze, an alloy of copper and tin, was in use before the time of recorded history, and some other alloys of the metal may have been known.

The relative importance of the metals changes with the shifts of development in the arts. In a progressive society nothing stands still. Some metals rise in relative importance, others decline. Inventions may reveal new uses for old materials, but not infrequently substitutes of such importance are discovered as to deprive an older substance of its relative position in the arts. In recent years we have observed the rise in the use of a number of the rarer elements, which were unknown a century ago, and for which, of course, no use could be imagined. Eckel states that "the ancient civilizations were built up, not on iron and steel, but on copper, tin, and gold; and each of these metals has over six thousand years of recorded history behind it."[1]

The Romans acquired considerable skill in the working of copper. The best raw material, known as *Cyprium aes,* or Cyprian brass, was imported from Cyprus, and from this came the name *cuprum,* and later *cuper* and *copper.* The American Indians were familiar with some of the uses of copper, and from this source the early explorers learned of the existence of some of the most important copper deposits in North America. Pierre Radisson, for example, the first white man to explore the shores of Lake Superior, was led by an Indian guide to a small stream which flows into the lake where he saw many small pieces of the metal, and he was told that there was a mountain not far distant which was composed entirely of this metal. In later years, these resources about the lake became one of the most important sources of the American supply.

The uses of lead are not as old as those of copper, but the history of the element is ancient enough to establish its claim as one of the oldest of the metals. Even in Biblical times it was an article of commerce. Imports into Palestine were obtained from Tyre, and possibly from Egypt, and local sources at Sinai and Lebanon may have been worked. The Romans employed lead, as well as copper, for a number of industrial purposes. They manufactured pipe and sheet, and sometimes worked the metal into various ornaments. Several lead deposits of Great Britain were worked by the Roman invaders. The Roman methods of production were employed far into the Middle Ages when European mines began to yield important quantities of metal. The compound, white lead, which has now become of great industrial importance, was known in the fourth century, and in the fifteenth century, Basil Valentine, the alchemist, explained how it was adulterated.

Zinc, in the metallic form at least, is of more recent history. While the ancients employed this metal in the manufacture of brass, their method was to heat copper with some of the ores of zinc, together with some carbonaceous material. This was done in large crucibles especially constructed for the purpose. The process was necessarily slow, as were all the early methods for the production of metals and alloys. For centuries, zinc seems to have had only one use, and that was to mix with copper in the production of brass. In the European countries zinc was not extracted from the ores, at least in commercial quantities, until about the beginning of the eighteenth century, and the fact that it could be made malleable and ductile was not known until nearly 1800.

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[1] E. C. Eckel, *Coal, Iron and War,* p. 158.

Through the ages the search for metals has led explorers into many parts of the world; this statement applies not only to gold and silver but also to the baser materials. In recent years, since the belief has begun to grow that the time is not far distant when such metals and copper and lead will not be found in large enough quantities to supply the growing needs, a new incentive has been given to world exploration. The presence of metallic resources has always been an important factor in the distribution of the population of the world, and this influence will continue to operate with the discovery of new resources.

COPPER

Uses of Copper

The highly diversified use of copper is a modern phenomenon. Until the beginning of the electrical era this metal was consumed chiefly in the production of a few household articles such as kettles and bottles, in ornaments, and in brass-making, and this alloy in turn was employed largely in the manufacture of ornamental ware. The total world production of fine copper in 1850 was only 52,200 tons.

The growing consumption of this metal is partly the result of a more intense demand for the old uses, but it is more largely due to the diversification of industries. Copper is our second most important industrial metal, and it has attained to this place because, as with iron, its use penetrates into many of the activities of life. As with iron, also, the highly specialized industries of today are exacting in their requirements with respect to quality and properties of the material. Copper must be treated in one way when consumed for trolley wire, and in quite a different manner when it is to be used in the windings of a dynamo. In long-distance transmission lines, where great tensile strength is required, the wire may be only "copper clad"—as when steel wire is covered with copper. In specialized products like bronze or brass, the composition of the material is varied to meet some specialized need of the consumer. Thus, to say that copper is used in making alloy metal, munitions, coins, shipbuilding, in architecture and the arts, is to make only a general statement, for a number of varieties of materials must be supplied for each of these classes of consumption.

The growth of the modern demand for copper is almost contemporary with the introduction of great new inventions in the electrical industries. The telegraph was the only outstanding electrical device in commercial use before 1860. The developmental work on the telephone was performed in the decade from 1860 to 1870; the trolley was introduced in the next decade, and considerable attention was given to water-power electric generating plants in the decade from 1890 to 1900. Enormous expansion has taken place in all these uses. Today consumption of copper in the electrical industries amounts to about one-half the total, and electricity contributed indirectly to some of the other uses. The table given on page 175 will convey some idea of the present distributions of the uses of copper.[2]

The consumption of certain compounds of copper adds further to the diversification of the demand. Copper oxide is a rather important material in the petroleum business where it is used as a desulphurizing agent. The sulphate of copper is employed as a mordant, and in the preparation of insecticides and germicides, to say nothing of its use in electroplating and in the operation of certain kinds of electric batteries.

Certain economic and physical conditions add greatly to the utility of copper. While the metal is not as abundant as iron, Nature has provided sufficient quantities for present uses, and thus the price is not prohibitive. Silver is a much better conductor of electricity, but it is not abundant enough for supply

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[2] Table from Stoughton and Butts, *Engineering Metallurgy*, p. 236.

DISTRIBUTION OF COPPER CONSUMPTION IN THE UNITED STATES

Use	*Per Cent*
Electrical manufactures	25
Light- and power-transmission lines	13
Telephones and telegraphs	11
Trolley wire	1
TOTAL ELECTRICAL USES	50
Other wire and rods	8
Wire cloth (screening)	0.5
Automobiles	14
Buildings	6
Bearings and brushings	5
Valves and pipe fittings	3
Railway cars and locomotives	2
Ammunition	1
Other uses	10.5
TOTAL	100

at moderate prices. Copper is the best conductor of electricity of any metal except silver; but this property alone would not make it available for electrical use. It is easily drawn into wire, it may be treated in various ways to suit specialized demands, and it resists destructive corrosion. As with iron, in many of its uses copper must be exposed to the weather; but while it rusts it does not disintegrate, as is the case with iron. In fact, the small amount of rust which accumulates on copper serves to protect it against further decomposition. The metal is hard and tough, and may be easily bent, or drawn into fine copper wires, or hammered or rolled into thin copper sheets. Mixed with other metals, as alloys, it produces many different kinds of materials which have important commercial uses.

Copper Resources of the World

There is uncertainty enough in our estimates of the world's reserves of iron, coal, and petroleum. But the conditions are even more complicated with copper. With many metallic ores the character of the deposits is such that the magnitude cannot be determined with any degree of accuracy until the resource has been rather thoroughly exploited. Add to this the facts that many parts of the world have never been adequately surveyed, and that the metal resources of some very large areas are entirely unknown, as in portions of China and Africa, and it can be understood that an estimate of the world's reserves of copper, which might be made available with even our present knowledge of production, is merely a guess. Moreover, improvements in mining methods are making possible the development of lower-grade ores, and there is no reason why this kind of progress should not continue. In case of some of our mines, engineers of twenty-five years ago prophesied that the resource would be exhausted by today, yet these properties are still yielding large quantities of ore and the end is not in sight. In all cases, estimates must take into account possible improve-

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Modern electric ore haulage in a copper mine

ments in metallurgy and in processes of manufacture also, possible economies in the consumption of the material, and the prospective development of substitutes for various purposes. The appearance of any of these conditions tends to prolong the life of a reserve.

At present large quantities of ore are mined in the United States (Arizona, Utah, Montana, and Michigan being the largest producers), in Mexico, Chile, Japan, Canada, Tasmania, and Queensland. Within the last four or five years the Katanga fields, in the Belgian Congo, have attracted a great deal of attention, and it is possible that these sources are among the most important in the world. It is amazing that large quantities of copper should now be obtained from what was a few years ago one of the most remote areas of the earth. From 1913 to 1925 inclusive, production from these sources increased from 8,100 short tons to 99,300 tons. Thus a region with an insignificant output some fifteen years ago has become the third largest producer in the world. The lack of adequate transportation and the difficulties in securing labor retard more rapid development at these mines.

During the last two decades, large amounts of American capital have been invested in properties in Chile, with the result that the country is being restored to its former preëminence as a producer. The output has grown steadily from 46,500 short tons in 1913 to 209,600 tons in 1925, and even now production is not at capacity. This growth has made Chile the second largest producer in the world. Canada is also gaining in importance. New discoveries in the last year or two promise to enhance the importance of the Canadian reserves. Likewise, recent discoveries in some of the western regions of the United States add to the significance of the North American deposits. The total world output of copper in 1925 amounted to about 1,526,900 short tons. The production by countries is given in the table on page 178.

In 1925 the Americas produced about 80 per cent of the total for the world, and of this amount the share of the United States was a little more than 54 per cent. Europe produced about 7 per cent. Since the western countries of Europe are

COPPER PRODUCTION OF THE WORLD BY REGIONS, 1925

Region	*Short Tons*
United States	837,434
Chile	209,657
Belgian Congo	99,323
Japan	72,413
Mexico	56,588
Canada	55,725
Spain	43,441
Peru	40,738
Germany	25,353
Cuba	15,983
Australia	13,235
Bolivia	7,975
Russia	5,952
All others	43,179
TOTAL	1,526,996

large consumers of copper, the supply must be obtained largely from the Americas and from the Belgian Congo.

A comparison of conditions today with those of 1850 reveals a great change in the importance of the producing sources. At the former date Chile was first in rank, with Great Britain second. As with other materials, copper is produced under competitive conditions, and various features of production and sale tend to work changes in the relative importance of the producing regions. Many of the old mines have been abandoned because of inability to compete with the newer and more prolific sources. Copper, like every other commercial substance, is produced under a wide range of costs. Among the operating mines in the Americas this range is from a little less than 7 cents per pound to about 12 cents. In the Katanga area the cost is said to be less than 7 cents. The opening of a great new low-cost resource leads to the suspension, or abandonment, of those enterprises which cannot compete. The future promises no more stability than the past. The rapid growth of production in the Belgian Congo and in Chile, and the prospective developments in Canada, may upset all present relations, and shift the weight of production to other regions. The present integration in the copper business, and the great combinations among producers, may retard these shifts, but cannot prevent them.

Production of Copper in the United States

The first copper produced in the United States was obtained from the Simsbury mine at Granby, Connecticut, the history of which dates back to 1705. Metal-workers in the Middle Colonies obtained small quantities of copper from the Gap mine (as early as 1732) in Lancaster, Pennsylvania, and from the Schuyler mine (1719) near Belleville, New Jersey. In time, other small resources were developed largely for local supply. With the increasing demand which attended the growth of industries after 1820, the mines of the United States could not supply home consumption and imports were brought from Chile and Cuba. But the opening of the reserves of Michigan, shortly after 1845, not only made this country independent of outside sources, but made possible a growing export of the metal. The resources of the Rocky Mountain states had been known for years, but mining in these regions depended on the building of railroads. With the opening of the Far West, particularly after 1880, development has been rapid. The new demands growing out of the expansion of the electrical industries afforded a great stimulus to development. The expansion of our industries is constantly diversifying the demand for copper. As we have seen on a former page the automobile industry now consumes 14 per cent of the total, and the newer demands for the material in the building trades contribute further to this diversification. Production in this country in 1860 amounted to only 7,200 long tons. And in 1880 it was only 27,000 tons. The period of rapid industrial growth in the United States dates from about this year. Enterprises were just entering upon a period of great expansion. Many business combinations were coming into existence, business methods were improved and markets were growing beyond all previous expectations. These changes not only produced more intense demands for copper, but brought about many new uses. Meanwhile, the developments

The Anaconda Copper Mining Company reduction works at Anaconda, Montana in the electric industries brought a new source of demand. By 1890 the production of copper had increased to 115,000 tons; in 1900 it was 270,000 tons, and in 1925 it was about 837,000 tons.

One remarkable aspect of the copper business, if we may judge by the price, is that production has more than kept up with the increase in consumption. The annual average price of copper in 1850 was 22 cents per pound. During the Civil War period the price reached 47 cents (1864); it declined to 21 cents in 1870, and from that time, until the outbreak of the recent War, it rarely advanced beyond that figure; in fact, from 1885 to 1905 the annual price range was from about 10 to 16 cents. In 1916 the average of electrolytic copper (New York) for the year was 27.2 cents. The price declined rapidly with the return of peace, and in the face of increasing consumption. The average for 1926 was 13.7 cents per pound.

Exports of American Copper

Because of the small production of copper in Europe, the manufacturing countries of this part of the world must obtain the metal from outside sources. France, Germany, and the United Kingdom have been the largest consumers of American copper. In 1913, France imported 156,000,000 pounds, and in 1926 178,000,000 pounds; Germany imported 435,000,000 pounds in 1913 and 360,800,000 pounds in 1925; and the United Kingdom imported 120,000,000 pounds in 1913 and 220,600,000 pounds in 1925. Other European countries also consume large amounts of American copper, in addition to supplies brought in from South America and the Belgian Congo. The United States is also a large importer of copper in various forms, such as metal, ore, and unrefined copper. This is used largely for manufacture and reëxport.

Electrical Progress of the World

During the last twenty-five years the industrial regions of the world have made great strides in "solving the problem of reorientation of industrial production on a basis of electrical power." It has been estimated that in 1925 the total capital expended on the supply of electricity throughout the world was about $15,000,000,000,[3] and that even in the most advanced countries of Europe less than 20 per cent of the potential electrical development has been reached. The possible future features in the production and distribution of electricity may be outlined as follows:

1. The introduction of increasingly high temperatures and pressures in boilers and in steam turbines.
2. The utilization of substitutes for high-grade coal as fuel, rendered possible through improved methods of combustion.
3. The installation of larger generating units and the concentration of power production in large generating stations.
4. The creation of extensive power zones with interconnection between zones to cover wide areas.[4]

Marked progress has been made in each of these lines, and there is the promise that much more economical use of fuel and of the more extensive development of water power will further these developments. Thus, "the heat equivalent of the electricity generated by the turbine and generator in combination, taken as a percentage of the total heat contained in the fuel burned under the boilers, has been 25 per cent—not a high figure even now, but more than twice the average ruling twelve years ago. With higher temperatures and pressures it is possible to use the steam for power generation in high-pressure and low-pressure turbines before passing it into the condensers, to obtain in this way, greater power per unit volume of steam, and reduce accordingly the dimensions of the boilers and economizers."[5] The expectation of surprising economies are offered by these new developments. It is claimed, for example, that "in a short time thermal efficiencies of 33 per cent and above will be reached instead of 16 per cent and 18 per cent realized at present." This signifies that in the future one ton of coal can be made to produce as much power as is obtained at present from two tons. In addition, pulverizing of coal has enabled power-station engineers to use a low-grade fuel, because the latter, in powdered form, is more completely consumed and more easily controlled in combustion than when used in lump form.

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[3] *Europa,* 1928, p. 94.
[4] *Ibid.*
[5] *Ibid.,* p. 92.

Prospective developments, therefore, seem to indicate not only a great increase in the use of electrical devices, but a far greater consumption of copper. As with many other materials, these changes have taken place only in a small area in the world, and among a relatively small percentage of the world's population. When the fruits of electrical progress are brought to the older and more densely settled parts there is some doubt whether production of copper can keep pace with consumption, unless great new sources are discovered. At any rate, the tax upon the resources will be much greater in the future than it has been in the past.

Possibly this is the source of inspiration which is leading to further exploration, and to the combination of the world copper-producing properties in the hands of a relatively small number of great companies.

Control of Copper Resources

Copper production and refining in the United States is controlled by four or five great groups of producers, including the Morgan-Guggenheim, the Rockefeller-Ryan, and the Phelps-Dodge interests. Considerable amounts of English capital are invested in American copper enterprises usually in the form of stock ownership, but in a few cases by actual control over producing properties. In the case of the American companies control may be exercised through ownership of mines, or of smelters and refiners, or through organizations which sell the finished copper. With some of the large companies the industry is highly integrated, including company control over the operations of mining, smelting, refining, and marketing the products at home and abroad.

American capital largely dominates production in the Americas. In addition to large investments in the United States, the enterprise of this country is engaged in copper mining in Mexico, Chile, Peru, and in Canada. The copper enterprises of Latin America have also attracted British and French capital.

Canadian resources are exploited by British, American, and Canadian capital. British capital largely dominates the situation in the new copper-producing regions of Africa, although in the Congo, Belgian interest is linked with that of the British.

LEAD

The Uses of Lead

With the expansion of industries, lead has grown rapidly in importance as an industrial metal. The appearance of new uses, particularly since 1880, has added greatly to the consumption of this material. In one form or another, the electrical manufacturers now absorb from 35 to 40 per cent of the total, and consumption in building and chemical construction and for paint from 25 to 30 per cent of the total. In the form of foil, lead is employed as a wrapper or container for a number of commercial products, amounting to 4 or 5 per cent of the annual consumption. The manufacture of storage batteries, one of the chief electrical uses, requires about 20 per cent of the total consumption.

The chemical and physical properties of lead make the metal particularly useful in some kinds of industries. It is practically unaffected by atmospheric conditions, and it resists the action of moisture, and even of water, under ordinary conditions. For these reasons it is used as a covering or protection for various commodities. Chemical producers find it of great value, because under most conditions, it withstands the action of sulphuric acid and may be used, therefore, in the construction and lining of all kinds of tanks and apparatus which are used in connection with the manufacture of this acid.

Lead is soft, pliable, and ductile—properties which make it useful in the plumbing trades. Its low melting point sometimes adds to its usefulness. It enters into combination readily with a number of other metals, producing materials of highly specialized character. One interesting alloy is formed by mixing lead, antimony, and tin in the proper proportions. The product, known as type-metal, has the peculiar property of expanding when it solidifies, and is therefore of great aid in the making of printer's type because of the sharpness and definition which it gives to the casting. Pewter, another alloy of tin and lead, was used extensively in former times for food containers and tableware, and it is employed even today, to some extent, in the production of trophies. Solder contains lead and tin, and sometimes, where a low melting point is desired, a little bismuth is added, or in the case of hard solders, copper, zinc, and tin are necessary ingredients. The skill of the manufacturer in blending metals is one of the most interesting aspects of modern production. Lead is only one of the metals which may be treated in this way, but whatever the metal thus employed, the result is to satisfy more or less exactly the needs of the consumer, whether he chances to be in home or factory.

Ever since the introduction of firearms lead has supplied the material for the manufacture of shot and bullets. In many cases, manufacture has been of most primitive kind, as in the early days in Missouri where the cliffs overhanging the Mississippi River were improvised shot towers. Molten lead was poured through sieves projected from the top of these elevations, and dropped into pans on the bed of the stream. The modern manufacturer of munitions has not been able to get along entirely without the use of lead.

Basic lead carbonate is one of the most useful of the compounds. It has been used for centuries in the manufacture of paint, and while it has the disadvantage of being affected by the acids in the air, still its merits outweigh its faults. Among other things, it may be easily worked with oil, it can be readily applied, it mixes easily with other pigments to form various tints, and it possesses a great covering power. Another compound, lead oxide, is used extensively as a drier in paint oils, in the manufacture of rubber goods, and as a raw material for the production of a large number of lead salts. Red lead is consumed in the production of paint—used in the protection of iron and steel structures and machinery—and in the manufacture of glass. Other compounds have commercial uses of varying importance.

World Resources of Lead

This metal is often found in nature in connection with silver and zinc. In fact, the ores are sometimes classified as argentiferous and non-argentiferous. When silver is present in considerable quantities it is usually profitable to separate that element and sell it as a kind of by-product, although in times of depression in silver prices, the producers of the white metal complain that this practice further lowers the price of their product. Zinc, also, is often associated with lead, and some minerals contain in addition manganese, cadmium, cobalt, nickel, and even gold. In some cases these other metals may be of commercial importance; but, at times, their presence may be a source of embarrassment not only because they add to the difficulties of production, but because of the depressing effect on the price of the metal which is more or less of a by-product.

Deposits of lead exist in a number of parts of the world. A good many sources which once yielded a considerable supply have been abandoned because of inability to compete with production from the richer deposits. At present, the United States is the chief world producer, but large quantities are also mined in Spain (Córdoba), Germany, Mexico, and Australia. Varying quantities are mined in at least eight European countries, but, at that, Europe supplies only about half its needs, and the remainder is imported from Australia and the United States. The total world output of lead in 1927 was estimated at 1,828,000 short tons.

World Production of Lead, 1927

Country	*Short Tons*
United States	678,000
Mexico	267,000
Australia	185,000
Spain and Tunis	168,000
Canada	151,000
Germany and Silesia	121,000
Burma	73,000
All others	185,000
Total	1,828,000

Production of Lead in the United States

The American colonies did not produce enough lead to supply the whitesmiths and small quantities were imported. The earliest lead mining of any importance was carried on in southeast Missouri, beginning about 1720. The inauguration of this business was a by-product of the quest for precious metals, and had its immediate origin in the activity of John Law and the organization of the Company of the West. Most alluring reports of the mineral wealth of the Mississippi Valley had been circulated in France, together with maps which for the convenience of the explorers showed the approximate location of the deposits. In 1719 Philip Francis Renault was made director general of the mining properties of the company in Illinois and was sent to develop the mines. After some time of fruitless search, Renault gave up the hope of finding precious metals and settled down to the mining of lead in Missouri. In 1741, production at Mine La Motte, one of the earliest enterprises, was 2,220 pigs. These sources in Missouri supplied trappers far and wide; the metal was exported to Europe and to the seaboard colonies of America. A portion of the lead listed as imports into the New England colonies originated in the mines of Missouri. Shortly after the close of the War of 1812, lead mining was started on a considerable scale in northern Illinois, with Galena as the commercial center, and in Iowa and Wisconsin, and for a number of years the lead trade was not only a basis of prosperity, but the occasion for the first settlement of some of this area. Shortly after 1825 the United States became largely independent of foreign lead, and was more and more an exporter. Production in 1830 amounted to 8,000 short tons, and in 1850 to 22,000 tons.

As with other mineral products, the period of most rapid production began about 1880, accompanying the general industrial expansion of the country. In that year the output was 97,800 tons. The electrical industries contributed to a marked degree to the subsequent advance of the industry. Production became 436,000 tons in 1913. Consumption is destined to increase, and the problem of more economic use applies to lead as to all other metals, for the resources are not overabundant.

ZINC

Industrial Uses of Zinc

The most important use for zinc is in the galvanizing of iron and steel—a process which protects these products from rapid decomposition when exposed to the elements. But the zinc itself is "gradually oxidized, so that unless galvanized coatings are made thick their usefulness lasts only a comparatively short time."[6] The process is usually performed by dipping the iron or steel sheet for a few moments in molten zinc at a temperature between 425° and 460° C.

The second most important use of zinc is in the manufacture of brass. This alloy is composed chiefly of copper and zinc in varying proportions, depending upon the chemical and physical properties demanded by consumers. Brass is itself an important industrial material, being the raw product for the manufacture of many commercial articles. It is used for "worm wheels, gears, propellers, bearings, steam fittings, tubing, non-corrosive castings, valves and valve stems, engine parts, pump castings, cartridges, hardware, ornaments, automobile parts, etc."[7] Zinc is used in the refining of lead, and under certain conditions in the recovery of gold and silver. A few compounds of the metal have important industrial uses. Zinc oxide, for example, is consumed in the manufacture of paints and rubber tires; the chloride of zinc is a valuable preservative for wood. It is estimated that the zinc content in these various compounds which are consumed annually in the United States amounts to about 200,000 tons. These compounds, however, are not manufactured from the metal, but directly from the ores.

World Production of Zinc

The mining of zinc is scattered widely over the world, but the greater part of the world's supply is produced in a small number of places. Between 40 and 50 per cent of the total is now mined in the United States. In this country mining is carried on principally in three areas. The Mississippi Valley region is the most important. It includes portions of Missouri, Kansas, Oklahoma, and Arkansas. In 1926, this area produced about 60 per cent of the total for the United States. The western region includes important deposits at Leadville, Butte, and Cœur d'Alene; and in the eastern section of the country zinc is produced in New Jersey, New York, and in a few places in the New England states. Mexico and Canada also produce considerable quantities of zinc, the Mexican production coming largely to the United States for further treatment.

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[6] Stoughton and Butts, *op. cit.*, p. 153.
[7] *Ibid.*

In Europe resources are also widely distributed. Zinc is produced in Upper Silesia, Rhenish Prussia, Westphalia, Saxony, and Hanover; the Italian production is located chiefly in Sardinia; in Spain ore is produced in Biscay and Santander, and in other places. Poland is an important source. The Russian supply is produced in the northern Caucasus and in the Altai Mountains in southwestern Siberia, where the ore is mingled with lead, silver, and copper. The metallic content of this area is estimated at 10,000,000 tons, of which 1,200,000 short tons are zinc, and 550,000 are lead. Mining is also carried on in Tasmania and in New South Wales. Japan produces considerable amounts of zinc from the province of Hida.

In 1927 the total world production of slab zinc was estimated at about 1,450,000 tons, of which the United States produced 612,000 tons. Belgium was the second most important producer, followed by Upper Silesia and France. Apparently Europe is mining enough of this metal to satisfy its present needs. In the United Kingdom, however, production falls below requirements and zinc is imported from Canada and Mexico.

As with other metals, there is a great deal of shifting of enterprise from one region to another. Some forty years ago Germany was the largest producer, followed by the United States and Italy. Today, the United States ranks first in importance. Future supplies may come more largely from the Far East. Burma is said to contain large deposits and portions of Asia are believed to contain large quantities of the metal. In most cases, exploitation is carried on with foreign capital, and the ramifications of control resemble the conditions with other important minerals.

Although the production of both lead and zinc is beset periodically by overproduction, the prospective output from the known sources will probably fall short of future needs. As yet the more densely populated parts of the world have not made known their wants. When these countries grow in wealth, and when their demands are added to those of the United States and Europe, consumption requirements will be many times as great as they are today.

QUESTIONS

1. In what respect are the uses of copper today different from those of ancient times?
2. Why were the ancient civilizations built on copper and gold and not on iron and steel?
3. How does the development of mining and metallurgical technique affect the manufacturing uses of a metal?
4. Show that the quest for metals, both precious and base, has been an important factor in exploration and discovery.
5. In what ways do the chemical and physical properties of copper contribute to its present uses? What new uses are largely responsible for the increase in demand for copper in recent years?
6. Estimate the commercial and industrial importance of copper. Is there an adequate substitute for this metal?
7. Silver is a better conductor of electricity than copper. Then why do we not use silver instead of copper in the electrical manufactures?
8. State the present distribution of the copper resources of the world.
9. In what important ways would we be compelled to change our systems of industry and mode of life if the copper resources should become largely exhausted?
10. Can you explain why Chile which lost its former position as a copper producer has recently been restored to high rank?
11. In what respects do competitive conditions decide what resources shall be worked?
12. Why has the price of copper declined in recent years in face of a rapidly increasing demand?
13. Discuss the question of capitalistic control in the copper industry.
14. Name the chief uses of lead and zinc.
15. Are these metals as important for present industry as copper and iron? Why?
16. State the present world distribution of the lead and zinc industries.
17. What chemical and physical properties contribute to the expanding uses of lead?
18. Give a history of lead mining in the United States.

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CHAPTER X

THE MINOR INDUSTRIAL METALS

The title of this chapter should not be taken to mean that the industrial importance of a metal can be judged entirely by the quantity produced, or by the market value of the annual product. A number of the minor metals are produced only on a small scale but they may exert either a direct or an indirect influence on important industries. Some of such substances have been called key materials because the economic organization into which they enter depends upon them.

From a commercial point of view such metals as tungsten, vanadium, antimony, and even aluminum and platinum may be regarded as new materials. Industry found little or no use for them several decades ago. Aluminum, for example, was first produced in the free state about 1824 when Oersted succeeded in separating it from its compounds; and although Bunsen and Deville, working independently, produced metallic aluminum by the electrolytic process, it was not until the introduction of the Hall process, about 1890, that it became possible to manufacture aluminum on a commercial scale. As far as the average person was concerned, the metal was a curiosity, interesting because of its lightness. Because of the processes of production in vogue as late as 1887 the price of the metal was about $5.00 a pound. In recent years the price has been as low as 18 cents. With the discovery of means of producing aluminum on a large scale the use of the metal has become as diversified as that of any other article of general consumption. It is a great tribute to the exploring spirit of the age that a new substance which less than fifty years ago had practically no known commercial use has become an indispensable commodity for the ordinary consumer. This is the case, not only with aluminum, but with a number of the other newer metals.

RELATION OF RESOURCES TO DIVERSIFIED MANUFACTURES

The chemical elements are by no means equally abundant, nor are they all of importance in the maintenance of life and the development of industry. But the tendency of industrial development during the last half century has been to push more and more into the realm of the nonusable materials for the purpose of converting them into valuable commodities. Possibly only eleven elements are absolutely indispensable. The list includes carbon, hydrogen, oxygen, nitrogen, sulphur, calcium, sodium, chlorine, iron, potassium, and phosphorus. With the addition of four more, namely, silicon, aluminum, magnesium, and fluorine, savage life would be possible.[1] In fact, an inventive or resourceful savage might even have created a rather advanced civilization with the aid of only the fifteen elements named above. But modern society finds rather effective use for gold, silver, platinum, zinc, and tin, and some persons might contend that these also must be supplied for a high standard of civilization. If human beings could exist on a simpler scale of living, why struggle for anything more? The answer carries us temporarily out of the realm of physical resources into the domain of human values.

It would be possible for us to live comfortably with a coach and four, but since the invention of the gas engine, and the advent of advertising, we seem to think that the automobile is superior to the coach both for social and for commercial purposes. But once we have reached this decision it has become necessary not only to manufacture a great deal more iron and steel, but to search the earth for nickel, chromium, manganese, aluminum, copper, and other elements, in order to make this machine as durable and as serviceable as possible. Our search also includes tungsten and vanadium, for these elements entered into the tools and machines which helped to manufacture the automobile.

On the Fourth of July we could get along happily without red and green lights, and the noise; but if people place a value on celebration someone must scour the world for barium and strontium or their compounds. Electric and gas light supply a comfortable medium for illumination, but if we can be convinced that the Welsbach burner serves a better purpose, the business agencies must supply us with cerium and thorium and diligent search must be made for these materials. Likewise, a high standard of civilization can exist on water as the only beverage, but if consumers place a high social value on coffee, tea, cocoa, and on innumerable soft drinks and their various blends, someone must explore the earth for the raw materials for manufacture; farmers and miners must be organized for production; and the economic organization must supply the intricate commercial machinery for bringing these commodities to market.

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[1] Hesseler and Smith, *Chemistry*, p. 6.

According to the current conception, evolution involves differentiation. From the consumers' point of view, society has placed a value on diversified products. A high degree of division of labor and specialization is therefore necessary to carry on social life in accordance with the consumption ideals of what we call the more advanced peoples.

Nor is this all. From the production standpoint, our civilization is based on power and speed. This means heavy machinery and heavy structures, bridges and rolling stock, and powerful stationary and traction engines. Machinery and structures of all kinds, under our present system of production, are subjected to enormous strain. Industrial materials must not only be hard, but tough and durable according to their use, and they must possess these qualities in accordance with the more or less exacting standard of the industry in which they are used. Some of these properties may be imparted by process of manufacture, but the addition of the newer elements gives an enormous advantage by making possible the satisfaction of more exact requirements to suit some very highly specialized use.

Under the competitive régime manufacturers must put their industries in a condition to economize in labor and time, or, to put it in other words, to enable their capital and labor to turn out the largest possible output. Only those producers can remain who achieve these results. The others must keep up with the pace, or abandon their enterprises. For one thing, progress in manufacture signifies the more or less exact adjustment of production materials to the uses to which they are put, and thereby power and speed in production, and quality of product, are realized.

TUNGSTEN

This element serves a number of industrial purposes, but one of its most significant uses is in the production of high-speed tools. When steel containing tungsten is hardened by rapid cooling it acquires the remarkable property of remaining hard even above the temperature where tempering occurs. In recent years the manufacturer has learned to make use of this property in the production of certain kinds of tools; tungsten steel may be raised to a dull red heat without losing its cutting edge. A steel-cutting tool, manufactured with the use of this material, can now be made "to do its work so fast that the edge of the tool will become almost red-hot before it loses its hardness." [2] As a result, the new types of cutting tools have worked a great revolution in the machine-shop industries. Sometimes, molybdenum is used for the purpose of hardening steel, but apparently it does not serve this purpose as well as tungsten. About 90 per cent of the annual supply of this element is employed in the manufacture of tungsten steel.

But other uses are now made of this material. It sometimes enters into the manufacture of "stellite," a product which has most of the characteristics of high-speed steel. It is used also in electric-light filaments, in the manufacture of X-ray tubes, and in the production of various alloys used in the manufacture of automobile and aëroplane engines. Manufacturers of phonograph needles, of wireless apparatus, and of minor chemicals use small amounts of tungsten.

Notwithstanding the important place which the metal now occupies in industry, the annual production is remarkably small. The total world output in 1913 was only 9,000 tons of ore. Production varies greatly from year to year, depending on the industrial condition of the industries into which it enters, but the world output has only once exceeded 40,000 tons, and the annual average since 1913 has been about 20,000 tons of ore.

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[2] Stoughton and Butts, *Engineering Metallurgy*, p. 193.

Small quantities of ore are produced in the United States, but the amount is rarely in excess of 5,000 tons a year. Imports are obtained from Bolivia, Chile, Mexico, and China, among others.

Tungsten is produced in many parts of the world, although in every case the quantity is small. In the United States, the Boulder, Colorado, field has been one of the most important sources, but there are indications that the best grade of material has already been extracted, and that what remains can be obtained only at higher cost. Other western states contain deposits. Of the foreign producers, China has become one of the most important. In 1924 this country contributed about 63 per cent of the total world supply. The shortage during the War was the occasion for the first development of the Chinese resources. "Occurring as the material does at the surface and being readily amenable to wet concentration with a simple plant, the mining of tungsten ore fits in particularly with Chinese methods, and within a short period the shipments were large enough first to dominate and then to break the market." [3] In China, the usual sequence of extracting the richest materials was followed and production is proceeding down to the lower grades; but, at that, this country still contains large quantities of ore, and it is expected to remain one of the most important sources. Tungsten is also produced in the Malay Peninsula and in Burma; several of the west coast South American countries, including Chile, Peru, and Bolivia, contain deposits.

ANTIMONY

For some time, antimony has shared the industrial fortune of the other industrial metals in the growing diversification of its uses. Like many other metals it readily forms alloys. Type metal contains antimony, lead, and tin; babbitt, antifriction, or bearing metal usually contains antimony, tin, and copper; britannia metal, sometimes known as "white metal," is composed of antimony, tin, and copper, sometimes with the addition of other elements. Antimony also enters into the manufacture of battery plates, toys, table coverings, and siphon tops.

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[3] H. F. Bain, *Ores and Industries of the Far East,* p. 149.

Industry also makes extensive use of the compounds. The trisulphide is contained in the composition on the safety match, or on the box itself. White antimony oxide is a material used in the manufacture of white enamel used in sanitary ware, competing in this use with tin oxide. Producers of red rubber, and of pigments for paints, use the red sulphides of antimony. The trioxide is also employed in the manufacture of glass. Producers of oil paints and of ceramic ware make use of the antimoniate of lead. Other compounds are used as mordants in dyeing, in the preparation of certain medicines, and in the manufacture of a kind of powder producing a white smoke which is an aid in range finding.

Many parts of the world are potential producers, but with the low cost in China, France, and Mexico, mining elsewhere is not profitable except in periods of high prices. The high-cost sources also labor under the threat of the use of substitutes when the price advances. Some ten or more such substitutes have already begun to have commercial value, and the number seems to be growing. Although deposits of antimony occur in many places in the United States, the American level of cost is above that in several of the foreign fields. Small amounts of the metal are produced, however, as a by-product of the lead industry. Some two or three thousand tons a year are obtained in this way. China is the chief source of our imported supply.

During the last decade the proportion of antimony which China has supplied to world markets has been constantly increasing, and because of the extent of the reserves, this country will probably continue to dominate the market for many years. From 1908 to 1916, China supplied about 50 per cent of the world total, from 1917 to 1920 about 60 per cent, and from 1923 to 1925 about 80 per cent. The low cost at which the material can be produced and delivered at American and European ports makes it difficult for producers at the higher-cost reserves to compete.

The most important centers of Chinese production are in the districts of Shinghua, Anhwei, Tiyang, and Paoching, although considerable deposits occur elsewhere. Since 1912 China has exported on the average of 12,000 to 15,000 tons a year, although in 1916, under the influence of the War demand, shipments rose to 42,800 tons.

In Europe, France is the most important producer, and a French company also controls reserves in Algiers. There is also a small production in Germany, Italy, Spain, and Russia. In South America, Bolivia and Peru give the greatest promise of supplies.

VANADIUM, CADMIUM, MOLYBDENUM

One of the chief uses of vanadium is to increase the strength and hardness of steel. Products of this description are particularly useful in the manufacture of automobile parts, gears, piston rods, boiler plants, transmission shafts, and gun barrels. A more recent development has been chromium-vanadium steel. Attempts have been made with more or less success to substitute titanium and molybdenum for vanadium. Certain of the compounds of vanadium are used in dyeing and printing, and the oxides of the metal are employed in the production of glass and pottery.

Cadmium is used to some extent with various metallic alloys for the purpose of reducing the melting point. The painters' trade finds use for the sulphide, marketed as a powder, and used chiefly as a pigment. When this element is worked with mercury it forms a soft amalgam which hardens easily and resists the action of weak acids. Because of these properties it is used as a cement in dentistry.

The chief source of the world's supply of vanadium is in a small district in Peru, about twenty miles from Cerro de Pasco. Small deposits also occur in a few of our western states—in Colorado, Utah, Arizona, and New Mexico. It is also found to some extent in other parts of the world associated with uranium and radium minerals. The Peruvian properties are controlled by an American company which operates the mines under a concession granted by the Peruvian government. This country uses vanadium as a source of revenue, imposing an export tax graded according to the selling price of the product.

Although cadmium exists in several mineral forms, the commercial product is obtained as a by-product in the smelting of certain kinds of zinc ores where the ratio of zinc to cadmium is about two hundred to one. Cadmium is also obtained as a kind of by-product in the production of lead, from the baghouse fumes. Cadmium was produced in the United States for the first time in 1906, when the output was only 300 pounds, but production has risen rapidly from that amount to 129,000 pounds in 1920 and to 810,000 pounds in 1926.

As with other rare elements, molybdenum is employed chiefly in the manufacture of certain alloys of steel. But there is a moderate demand for the material by manufacturers of leather; it is used to fix certain colors; in the coloring of silk and rubber; and in the production of glazes in porcelain. In several uses it has been found to be a satisfactory substitute for platinum, a highly desirable discovery because of the increasing scarcity of this metal. In this connection, it is used in winding electric resistance furnaces and in the making of electric contact-making devices.

Until about 1915 the United States imported practically all its supply of molybdenum. Queensland, New South Wales, and Norway were the sources of supply. But since that date the material has been produced in this country in large enough quantities to supply domestic needs, and upon occasion with a surplus for export. Deposits exist in Colorado, Arizona, and New Mexico. Reserves of smaller importance are in Mexico, Peru, and Spain.

NICKEL AND COBALT

Like zinc and tin, nickel has the property of resisting rapid decomposition when exposed to ordinary weathering conditions. This quality lies at the base of some of its most important uses. Nickel-plated ware has a wide use, as for example, in the protection of parts of machinery, the handles of bicycles, and various parts of automobiles. The plumbing and steam-fitting trades make rather extensive use of the metal in plating bathroom fixtures, faucets, radiator fittings, etc. The steel industry requires considerable quantities of nickel in the manufacture of a number of important alloys; it is sometimes used alone, but more often in combination with some other elements, such as chromium, in the production of chrome-nickel steel used for automobile forgings and armor plate, and with copper in the production of a considerable number of alloys, including so-called nickel silver, or German silver. The five-cent piece, in the coinage of the United States, contains a considerable amount of this metal. All in all, nickel enters into diversified consumption both for machinery, tools, and equipment used for productive purposes, and for personal or individual use.

The world supply is obtained from only a few places, but the quantity contained in these sources seems ample to meet the needs of industry for many years. The most important resource is in the Sudbury field in Ontario, Canada, in which mining began about 1889. Previously, the chief supply came from the French colony of New Caledonia. These two deposits contain an abundant supply. Scattered over the world are deposits of smaller importance. At one time a small supply was obtained from mines in Lancaster County, Pennsylvania, but mining at this source cannot compete with production in Canada and New Caledonia. The same remark applies to the limited resources in Italy, Germany, Greece, Russia, and Spain. The ores of the Far East have not been extensively surveyed, and it is possible that this region may contain important deposits.[4] In 1926 the United States produced only 306 short tons of nickel. It was necessary, therefore, for this country to depend upon foreign sources. Imports were brought in in various forms, including ore and matte, the oxide, and alloy in the form of pigs. Imports amounted to over 45,000,000 pounds in 1926. Production of nickel in Canada is affected by industrial conditions, depending on the state of the industries which consume the supply. In 1920 the Canadian output amounted to 61,300,000 pounds, while in 1921 production was only 19,200,000 pounds.

Because the world's active reserves of nickel are found only in very limited areas, and on account of the growing demand for the metal, it has been easy to concentrate financial control in the hands of a few companies. Nominally, control is vested in the governments in whose dominions the resources occur, namely, Britain (Canada) and France. But the actual operation of mining is in the hands of the exploiting companies working under conditions imposed by the respective governments. The Canadian reserves are being developed largely by Canadian and American capital, and those of New Caledonia by American and French interests. The nickel-bearing ores of Cuba are controlled by an American company.

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[4] Bain, *op. cit.*, p. 160.

Cobalt has been produced in the United States from time to time in small quantities, but the resources are not abundant, and development cannot be carried on at a profit unless the price is high. At best, the world consumption is very small, although the product is indispensable for the manufacture of some products. The supplies for the United States are brought from Canada which, during the last few years, has supplied nearly all the world's need. Cobalt is employed in the manufacture of a few alloys of steel. A certain kind of cobalt-steel produces a good material for permanent magnets. Some cobalt products find a use in the coloring of glass and as a drier for paint oils.

MANGANESE

The alloys of manganese are absolutely necessary in the manufacture of steel according to the present processes. Ferromanganese, carrying a high percentage of the metal, is consumed extensively in the manufacture of steel by the open-hearth process, while spiegeleisen, with as low as from 20 to 30 per cent of manganese, is used in the production of Bessemer steel. Attempts have been made to substitute inferior alloys, such as silico-manganese and ferro-silicon, but these materials cannot be used profitably under normal competitive conditions. They remain, however, as possible substitutes if occasion requires their use.

Minerals containing manganese are widely distributed over the world, but they vary greatly in manganese content, and in the ease with which they may be worked. Under a competitive régime, the mineral industries are dominated by conditions of relative cost, which means that production is carried on most extensively at the low-cost reserves, and that resources elsewhere can be operated only when favored by tariffs or possibly low transportation charges. At present, one of the greatest potential reserves is in Russia; several of the states of south Brazil also contain large bodies of ore. Some of the latter are controlled by American capital.

The United States contains abundant reserves of low-grade manganese ore, but is poorly supplied with materials of high quality. In the case of the American deposits: "Most of the ore of the second class (ore capable of beneficiation) cannot be mined at a profit under normal conditions in open competition with imported ore. This normal disadvantage, due to grade and cost, has been intensified by the acquisition of high-grade foreign deposits by American capital, particularly by steel producers, who are thus assured of a sufficient supply of high-grade ore, the present cost of which will probably be reduced by the adoption of more efficient methods of mining and transportation."[5] However, "regardless of tariffs and foreign competition," there is a prospect for some American ores being used more largely for flux by the western producers of copper, silver, and lead. The competition of the Russian material is usually a potential disadvantage for American producers.

Russia contains two great manganese-producing districts; the richer is on the Kvirila River in the Caucasus, and the other in the Government of Ekaterinoslav. The shipping points for the former region are Batum and Poti. At times, the production of this area amounts to over 800,000 tons a year. In 1925-1926 Russia exported about 662,000 tons of manganese ore.

The principal resources of Brazil are contained in Matto Grosso, Minas Geraes, and Bahia, in south Brazil. The extent of these deposits is known only in a general way, but it is estimated that the country can supply manganese for many years. One deposit in Matto Grosso is said to contain more than 30,000,000 tons of undeveloped ore. Demand, during the recent War, stimulated the Brazilian industry, and since the return of peace, production has been maintained on a higher level than in former years. In 1920, manganese was produced in eight countries in the Americas, ten in Europe, and three in Asia, to say nothing of production in several places in Africa and Oceania. In 1926, the output of the United States was 46,200 long tons of manganese ore bearing 35 per cent or more of metal, and 1,200,000 tons of manganiferous ore with from 5 to 35 per cent of manganese.

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[5] *Mineral Resources of the United States* (1921), Part I, p. 45.

TIN

The early metal-workers did not understand the art of separating tin from its ores, and this was probably true of copper, at least in the earliest years of metal-working; but by fusing a mixture of the ores of these two metals the artisan was able to produce a kind of bronze, and the subsequent task of working this material into finished forms was relatively easy. For centuries, the world obtained practically all its supply of tin from Cornwall, England. But Cornwall has sent out something more important than tin, namely, the Cornish miners who have spread the knowledge of the best mining practice in many parts of the world.

The rise of the modern consumption of tin is due principally to the use of the metal in the manufacture of tin and terneplate. With the appearance of this new demand Cornwall could not longer supply the world and it was necessary to search for new sources. Fortunately, rather abundant deposits have been discovered in at least two regions. But there is an element of misfortune in this situation also, because the new deposits are distant from the great centers of consumption.

The development of the manufacture of tinware was partly dependent on the prior discovery of mechanical devices for working plate into various wares. There is, of course, a close connection between the modern demand for tin and the growth of the canning industry. As early as 1810, the English government granted a patent to Peter Durand for preserving fruits, vegetables, and fish in hermetically sealed containers of tin, glass, or any other suitable material. For many years glass was preferred to metal, partly because of the high cost of manufacturing containers, and partly because of the fear of poisoning when fruits were put up in cans. The problem was to hermetically seal the can. The artisan succeeded in some cases, but in most instances he failed. Before the invention of modern machinery, the high cost of manufacturing tinware prohibited its extensive use. Prior to the invention of the stamp-can by Allen Taylor in 1847, and of the pendulum press by Henry Evans in 1849, can-making was a hand industry, and the best tinker could not produce more than sixty cans a day. The new machinery paved the way for more effective production. Many other inventions have been added to those of Taylor and Evans until this manufacture has become as highly developed as any other industry which uses mechanical devices.

The gradual abandonment of the home preserving industry has had something to do with the growth of the canning enterprises, but the changes of consumption habits of the people, the concentration of great numbers in the cities, the demand for products put up in sanitary ways, and above all, the sales promotion of the managers of the food-product industries have been effective factors in the development of the use of canned products; and the growth of the factory industry has contributed one of the most important of the demands for tin.

Although tin is produced in nearly a dozen places in the world, two regions, namely, the Federated Malay States and Bolivia, supply between 80 and 90 per cent of the present world output. Cornwall still produces several thousand tons a year, and a few thousand tons are produced in Nigeria, the Union of South Africa, Australia, China, and Siam. The United States produces practically no tin, although small deposits exist in a number of places. From fifty to one hundred tons are produced in Alaska as the result of placer working. But there is a considerable industry in the United States for the recovery of tin from alloys and chemical compounds. In 1926 upwards of 33,400 short tons were obtained in this way.

During the last few years the world production of tin has amounted to from 120,000 tons to nearly 150,000 tons annually. In 1926 the Malay States and the Netherlands East Indies produced about 80,000 tons and Bolivia about 33,000 tons. The world production for 1926 is shown in the appended table.[6]

WORLD PRODUCTION OF TIN BY COUNTRIES, 1926

(*tin content of ore*)

Region	*Long Tons*
Malay States	48,168
Bolivia	33,862
Netherlands East Indies	32,697
Siam	8,000
Nigeria	7,042
China	6,538
Australia	3,000
England (Cornwall)	2,064
Belgian Congo	1,500
India	1,296
Union of South Africa	1,124
Others	1,000
TOTAL	146,291

The United States is by far the largest consumer; imports vary from year to year, sometimes with very sharp rises and falls. Imports in 1927 were 159,000,000 pounds in the form of bars, blocks, pigs, etc. These products were valued at $100,800,000. The following table shows the destination of tin exported from British Malaya:

EXPORTS OF TIN FROM BRITISH MALAYA, 1927

Destination	*Long Tons*
United Kingdom	9,453
British possessions	4,968
Continent of Europe	19,772
United States	46,370
Japan	1,922
Other countries	1,288
TOTAL	83,773

There are some indications that the large-scale consumption of tin is merely a passing phenomenon. It is certainly true that the cost of production of the metal will be much higher in the future, unless more effective methods of production are discovered, or great new resources are revealed, and at present there is no prospect of the appearance, to any important extent, of either of these conditions. At the present time, tin is mined in the Federated Malay States almost entirely in open pits, and in recent years an increasing proportion has been won by dredging. It has been said of these reserves that "ten or twelve years hence the bulk of the rich secondary deposits of the Dutch East Indies, of Malaya, of Siam, and of Lower Burma, will have been exhausted."[7]

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[6] *New International Year Book,* 1927, p. 764.

China contains considerable deposits, but here too mining will probably follow its usual course from low-cost reserves to those of less, and still less, productive power. Higher prices are therefore in prospect. The most important district in China is at Kotchiu in southeastern Yunnan. Other small districts extend from southern Hunan through Kwangtung and Kwangsi into Indo-China. In the last few years China has produced from 6,000-10,000 tons a year.

The deposits in Bolivia, the second largest in the world, are located in the southwestern portion of the country in the districts of La Paz, Oruro, and Potosí. Production began in this country about 1895 and has risen steadily in importance. Tin is the most important export of Bolivia, amounting at times to more than 60 per cent of the total value of the commodities sent out of the country.

The mineral deposits of Oruro have been described as follows: "The lodes vary in thickness from a few inches to 10, 15, or 20 feet. Rich pockets are found 30-60 feet in diameter, and veins with stannic oxide fragments, running from 50 to 100 per cent. Cassiterite, tin stone, or tin with stannic oxide, is frequently with 55-60 per cent tin; this is sent to Europe as extracted. The percentage of tin in a lode is very variable, often 6-8 per cent, sometimes 15."[8]

What will replace tin in the industrial world when the rising price prohibits extensive use? In some respects the world is much more lavish with its consumption of tin than of any other substance. The irrecoverable wastage of iron is very large; but it is still larger with tin. By far the larger part of this metal which enters the manufacture of tin plate is gone beyond recall. There is some recovery even at the present time, and detinning has been urged, and practiced to some extent. But it is impossible to reclaim the metal which enters the tinware of general consumption without great expense. Possibly aluminum will be one of the first successors to tin, but it is just as probable that some steel alloy will be discovered to do the work. Or if these fail, a return to glass containers may fill the gap temporarily until something else is eventually discovered. For the minor uses, such as those of the various compounds of the metal, the world can still supply the demand for many years, although at a high price.

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[7] Bain, *op. cit.*, p. 164.
[8] A. S. Peck, *Industrial and Commercial South America*, p. 231.

With respect to present conditions E. C. Eckel says:

> Tin seems to be really a very scarce metal, far scarcer than its current commercial prices would indicate. The original deposits of tin ore in hard rock are commonly of very low grade, and it is only the occurrence of placer or stream deposits of tin ore which have kept down the price of tin within its past range. As the placer deposits are finally exhausted, unless they are replaced in the industry by new and important deposits elsewhere, or by great increases in Bolivian or other lode mines, the price of the metallic tin must continue to increase. Indeed, if the demands of the supply grow as fast in the future as they have in the past, the increase in tin prices may be very marked indeed, for at present there are no deposits in sight which give promise of affording largely increased tin supplies at present prices.[9]

This phenomenon is not unlike that of petroleum, for in both cases the industry is often threatened with overproduction, with at least partial exhaustion not far distant.

In some respects, the prospective loss of tin as a metal of extensive commercial use is regrettable. Because of some of its physical properties it is admirably adapted to its present uses and it may be difficult to find a satisfactory substitute. It is a rather inactive metal and tends to retain its bright finish under ordinary conditions. It affords an excellent protective coating for iron and steel, which accounts for its extensive use in the manufacture of tin plate. Tin is nonpoisonous, and can thus be employed in the manufacture of foil which is used as a wrapper for tobacco and food products. It is no less valuable in the manufacture of many alloys.

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[9] E. C. Eckel, *Coal, Iron and War,* p. 171.

ALUMINUM

Aluminum is one of the most abundant metallic elements in the earth's crust, but unfortunately, in many cases it does not exist in a form for easy and cheap extraction. The commercial product is obtained chiefly from bauxite, which is a mineral containing aluminum along with oxygen and hydrogen and some impurities. Aluminum also occurs as diaspore, and as silicate in common clay, kaolin, feldspar, and cryolite.

As with everything else, the question of relative cost decides which material will be used, and in the case of aluminum this cost is affected by present knowledge of extracting the metal, the availability of the raw material with respect to the market and cheap water power, among other considerations. Experimenters have worked with other aluminum materials, such as clay and feldspar, and processes using these minerals have been the object of invention, but thus far nothing has been found to compete with bauxite. This mineral exists in large quantities in many parts of the world, and unless inventors can discover cheap methods of production from other materials there is no occasion for a change. These other materials, however, will remain as potential reserves for use when the more prolific supplies of bauxite have been exhausted.

The largest sources of bauxite in the United States are in Arkansas, which produced 371,500 long tons in 1926, and in Georgia, Alabama, and Tennessee, which together produced about 20,600 tons in that year. In France the mineral occurs in the provinces of Var and Hérault, among others. A low-grade bauxite occurs in a number of places in Germany; several South American countries, notably French and British Guiana, contain reserves; and active resources are found in Italy, northwestern

Russia, Dalmatia, Spain, and India. France is the largest producer in Europe.

No other metal has entered general consumption as rapidly as aluminum. In fact, until about 1890 it had little or no commercial value, but it has now become an article of most diversified use. Aluminum is a very light metal; in addition, it resists destructive corrosion, it is very malleable and ductile, and it is a fairly good conductor of electricity, having about 61 per cent of the conductivity of copper. It is a satisfactory conductor if the wire is made with larger cross-section than would be required of the other metal. Aluminum forms alloys with all the common elements. The lightness of the metal, however, is the one peculiar quality which recommends it for many commercial uses. It enters into the manufacture of aëroplane and automobile parts, blades for fans, cooking utensils, and camp equipment; the foil is used as wrapper for food products; aluminum is a raw material for the manufacture of hairpins and hatpins, of optical goods and scientific instruments, trunks and carrying cases, and of frames for mirrors and pictures. Powdered aluminum is used extensively in the painter's trade as a foundation for bronze powder. With ammonium nitrate it forms a series of explosives which cannot be fired without a detonator.

One of the great tasks of the sales promoters of aluminum products is to discover new kinds of consumption for the metal, and they are meeting with remarkable success. A relatively new use of aluminum, or some of its alloys, is in the manufacture of structural parts of aëroplanes and seaplanes. The metal is now consumed in the production of furniture and in the equipment of railway and passenger coaches. It is also finding some use in the form of aluminum shingles and roofing material.

Bauxite also enters into a number of commercial uses, as for example, in the manufacture of artificial abrasives, and as a basis for the production of a considerable number of chemical compounds, which, in turn, experience a diversified use. By far the larger percentage of bauxite is consumed in the manufacture of aluminum, possibly from 60 to 70 per cent; from 10 to 15 per cent is used in the production of various aluminum chemicals, and from 15 to 20 per cent in the manufacture of abrasives.

The United States is the largest manufacturer of aluminum in the world. In fact, this country produces about one-half the world product. In 1925 the value of manufactured aluminum products was $127,800,000.

OTHER MATERIALS

Industry depends on various other minerals to satisfy its diversified needs. Mercury, for example, is not produced in large quantities, but it serves many purposes. Almadén in Spain is one of the oldest and best known sources in the world; considerable quantities of quick silver ores are produced in California, in west Texas, and in Mexico, to say nothing of small amounts produced elsewhere in the world. One of the most important uses of mercury is in the production of gold and silver. The compound, corrosive sublimate, is a violent poison. It is used as an antiseptic and germicide. Calomel, another compound, has been employed for many years as a medicine. Mercury is used extensively in scientific work, as with thermometers and barometers. It forms various amalgams; such a composition, using silver, is employed in filling teeth.

Bismuth is another interesting substance. Bolivia, which is a great producer of tin, is also one of the most important sources of bismuth. This element is used in certain medical preparations and in the production of certain alloys. It imparts a low melting point. Thus some of its uses are in the manufacture of fuses for electrical connections, fire alarms, and automatic sprinklers.

Possibly the time is not far distant when some of the elements which are now listed as of "no commercial value" may become materials of rather general consumption. This may be the fate of cæsium, indium, erbium, and germanium. These are rare substances, but the word "rare" may mean only that we have not yet discovered the sources, or that the element is as yet hidden in some very common material.

QUESTIONS

1. Can we judge of the industrial importance of a metal from the quantity produced? Why?

2. Name the most important minor metals, and give their chief industrial uses.

3. Account for the fact that aluminum, which fifty years ago was only a curiosity, has become one of the most widely used of the metals.

4. In what ways do scientific discoveries aid in the diffusion of uses of metals?

5. "The tendency of industrial development has been to push more and more into the realm of the nonusable materials for the purpose of converting them into valuable commodities." Give examples.

6. "If human beings could exist on a simpler scale of living, why struggle for anything more?" What have been the motives involved in this struggle?

7. What determines the scale of human values? Is there an absolute standard by which all human values may be tested? Is there an immutable standard? Why? Who decides what the standard shall be?

8. Explain how a rise in the standard of living affects the organization of industries, and the demand upon natural resources.

9. What is the significance of the use of various metals in the processes of manufacture?

10. Estimate the industrial importance of tungsten. If this metal were exhausted would it be necessary to make material changes in the iron and steel industry? Why?

11. Name the industrial uses of antimony.

12. Explain how the growing use of the minor metals has contributed to the diversification of industries? Has the diversification of industries affected the demand for the minor metals? How and why?

13. What are the industrial uses of manganese? What regions are the chief sources of supply?

14. Account for the development of the modern demands for tin. What regions are the chief sources of supply? What is the future of this metal?

15. Explain how mechanical improvements in the manufacture of tinware have contributed to the growing demand for tin.

16. What industrial changes will be necessary when the supply of tin is largely exhausted?

17. Is there any adequate substitute for tin?

18. Why does modern industry require so many different metals? Why do not iron and steel suffice?

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CHAPTER XI

PRECIOUS METALS AND PRECIOUS STONES

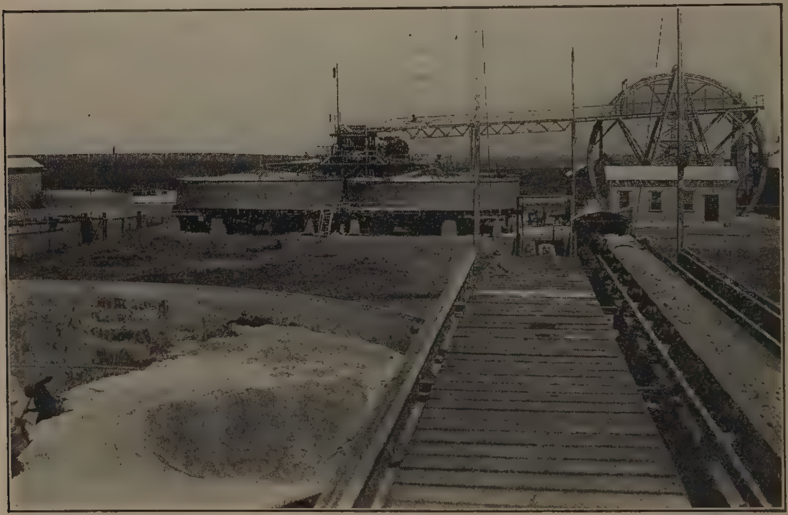
Gold, silver, and platinum are not usually called industrial metals, and possibly with some show of reason. They do not perform the heavy work which is required of iron and steel, and to a smaller extent of copper and other baser metals. But gold and silver enter the channels of commerce in the form of money and in this way greatly economize the human labor required in making exchanges. Thus the progress of industry has a vital concern with the existence of gold and silver, although they are not employed for mechanical purposes.

Since the beginning of gold mining in the Americas some four hundred years ago, about half the world output has been employed as money, and the other half for industrial purposes, in the production of jewelry and plate, and in some minor manufacturing and technical uses. Silver is still used extensively as money, although in most countries it is not under a free coinage system. Since the abandonment of platinum coinage in Russia some years ago that metal is employed entirely in the arts. If gold does not perform the heavy work of industry it serves modern society in other effective ways by providing enormous economies in methods of trading. In the richer countries, large sums of this metal are used as bank reserves, and in this use gold multiplies many times the credit transactions based upon the dollar, or franc, or pound, as the nominal unit of value.

INCREASE IN THE WORLD'S GOLD SUPPLY

Gold is one of the few metals that occurs in the native state. For this reason, even primitive man could make use of the metal. The beauty of gold has attracted people of all times and this fact, taken in connection with its scarcity, has tended to make it a highly desirable kind of property; so much so, that possession has always bestowed upon the owner honor, position, and prestige. Gold was probably a form of property long before it came into use as money. In fact, the money use was probably a result of its value as a possession.

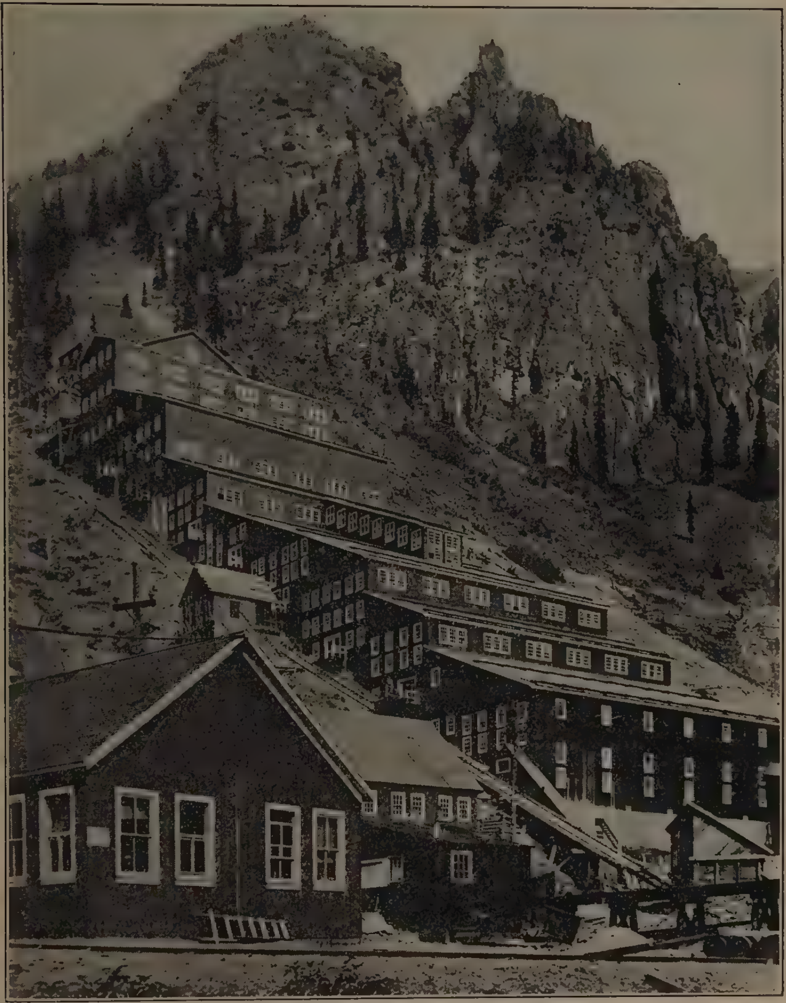
In another respect gold has served an important purpose in lifting people to higher standards of civilization. It is one of the most imperishable of the metals. It does not rust or corrode, and it is not readily affected by acids. While it is relatively soft, there is little or no loss by abrasion unless the metal is kept in constant use. For these reasons—and because of its worth—it has been used for ages as a store of value, and the modern employment as bank reserves is not far removed from its earlier use as a treasure, or hoard, except that the banks of today have found a way of manifolding credit based on gold.



Ewing Galloway

Cyanide tanks at a Witwatersrand gold mine, South Africa

The use of the metal as a store of value can scarcely be overestimated. Throughout the ages, practically everything that man tried to save was perishable. This was certainly the case with



Ewing Galloway

Sunnyside gold mill, Silverton, Colorado

livestock, in which wealth was once accumulated, and with grain and fabrics. In fact, in static societies where wealth is not developed by mechanical devices, gold and precious stones supply almost the only forms of imperishable accumulations.

The precious metals have not only promoted the development of societies through their use as money and as hoards, but they have been a most powerful lure in inviting adventurers into remote parts of the world, and thereby they have promoted exploration and development. One can obtain an estimate of the strength of this motive by recalling the hardships of the early Spanish explorers in America, and perhaps, the even more painful sufferings of the gold pioneers in Alaska. The presence of resources of gold and silver has spread people over many parts of the world as permanent settlers, and vast areas would have remained unclaimed today if it had not been for the stimulating effects of the precious metals. The rapid settlement of the Pacific coast area of the United States after the discovery of gold in 1848 is only one illustration, and the great flood of migration to the distant Bendigo field in Australia in 1851 is another example.

There seems to be no limit to a man's endurance and to his enterprise, except death, when there is a chance of obtaining the precious metals. In the Klondike area the average January temperature is about 37 degrees below freezing; but notwithstanding the hardships which the cold threatened to impose upon prospectors, more than 30,000 people came to this region during the first four years of the gold rush. Moreover, digging imposed great difficulties on the miners on account of the frozen condition of the earth. But "after various experiments they hit upon the following plan. They lit great fires which thawed the ground under them, and while the earth was still soft, the men dug it out and piled it up, ready for washing in the summer when the river ice would be melted. In the holes thus excavated they built more fires, thus gradually working their way down. Later on they adopted another method. By means of a strong hose and sharp nozzle they injected a continuous supply of hot steam from a large cylinder into the earth and thus melted it."[1]

In ancient times, gold was obtained from India, Asia Minor, Greece, and later from the Spanish peninsula. But the annual additions to the world stock were very small until the new American supplies began to appear about the middle of the sixteenth century. Since that time, three great discoveries have marked the progress of gold development. The first was the opening of the Peruvian reserves shortly after 1532, under the enterprise of Pizarro; the second was the discovery of gold in California in 1848; and the third was the finding of gold in the Witwatersrand in South Africa in 1885.

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[1] J. C. Cunningham, *Products of the Empire*, p. 235.

These were not only great discoveries, but they supplied the stimulus for further exploration, resulting in the opening of more extensive areas. The various Australian discoveries dating from 1851, and those of the Klondike region in Alaska, about 1898, have added other large sources of gold. The yellow metal is widely distributed over the world, and many sources have been worked, but the few regions mentioned above have been the largest contributors to our present stock. From early colonial times to the present, Bolivia alone is supposed to have supplied more than $4,000,000,000 of silver and several times that amount of gold; but these figures undoubtedly greatly overestimate actual production. From more authentic sources[2] the total production of

Dredging for gold in Alaska

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[2] *Statistical Abstract,* 1925, p. 717.

gold in the world since the discovery to 1925 has been estimated at 963,358,900 fine ounces valued at $19,912,600,000. At present, just about half this amount exists in the form of coin.

In 1926, gold was produced in three of the political divisions of North America, eleven of South America, fourteen of Europe, eleven of Asia, fifteen of Africa, to say nothing of scattered production in Oceania. The total world output this year amounted to $398,557,400. Production by continents is shown in the appended table.

WORLD PRODUCTION OF GOLD IN 1926, BY CONTINENTS

Region	*Value*
Africa	$226,413,274
North America	98,511,730
Asia	25,684,178
Europe	22,664,313
Oceania	13,508,917
South America	9,975,046
Central America and the West Indies	1,800,000
TOTAL	$398,557,458

It is evident from this table that the largest amount of gold is now produced in Africa. More than 57 per cent of the total comes from the mines of that continent. Production, however, is concentrated chiefly in small regions in South Africa, with the Transvaal outranking all others. Production from this source amounted to only $1,300,000 in 1885, but it rose rapidly to $192,100,000 in 1916. The output of the Transvaal, Cape Colony, and Natal in 1926 was $205,700,000. In 1926 only 22 per cent of the world total was produced in North America. The United States produced a little more than 11 per cent, namely, $46,200,000. Canada produced $36,200,000.

Upon first thought it would seem that these enormous annual additions to the present stock would work profound changes in banking and credit conditions over the world. It might be expected, for example, that this great increase in metal would afford a much broader basis for bank credit, with rising prices, and decline in the rates of long-term investments, as some of the important results. As a matter of fact, forecasters in the years from 1910 to 1915 looked forward with confidence to this outcome. And no doubt they were right, if the business world were to remain static while gold supplies increased.

But there are two sides to every business phenomenon, namely, the demand and the supply, and it is by no means certain that the increase in the world stock of gold will keep ahead of the world needs. In 1910, it was impossible to visualize the great expansion which was to take place during the next fifteen years. Likewise, no one can foresee what the credit needs of the European countries will be when they begin to share in the prosperity which the United States has recently enjoyed. Business expansion in Europe means a greater demand for gold to serve as the basis of bank credit.

Nor does this give a full account of the future. The present supply of gold is largely absorbed by a few rich industrial nations. Regardless of prospective needs, all the others have very little. At some time in the future, with the development of industries and commerce, these other nations will lay claim to a much larger proportion of the world stock. The populous countries of the Far East, which will not always remain industrially backward, are poorly supplied with the yellow metal. In May, 1927, the gold holdings of Japan were about $541,700,000. When China and India, for example, reach the industrial level of Japan, their demands for gold—if they use that metal for bank purposes—will be much greater than those of Japan. Business expansion elsewhere in the world requires this metal. Relative to present needs, the world may be able to get along with the present additions to its stock, but relative to the future it may be quite a different question. All in all, there is in prospect a much greater demand for the metal in the future, and there may be some doubt whether the mines of the world can supply the product on a basis that will promote the prospective development.

Nor does this give the full account. All the new gold does not enter the money uses. A considerable proportion of the annual supply is destined for the industrial arts, and this use seems to be increasing. From 1880, when the first data were collected, to 1922, upwards of $1,292,000,000 was consumed in this way. The new gold constituted $956,700,000 of this amount, the remainder being old material. In 1922 consumption in the industrial arts throughout the world required $100,900,000, which was a little less than 30 per cent of the world production. Thus, all the mine production is not available for banking or for coinage.

STOCKS OF GOLD IN THE LEADING COUNTRIES

In 1927 the monetary gold stocks of the world were estimated at $9,203,000,000. In May of this year the United States held $4,609,000,000; England, $741,600,000; France, $710,600,000; Germany, $444,100,000, and most of the remainder was distributed among Japan, Spain, Italy, Holland, and Canada.

In most instances these large reserves have been built up at the expense of gold in circulation. This partly explains why European reserves have grown in spite of the drain of gold to the United States. "The results of the withdrawal of gold from ordinary currency purposes is seen in the building up of the gold reserves of the Central Banks, which in nearly every case are much greater than in 1913. The absolute increase is greatest in Great Britain, the gold reserve of the Bank of England having increased from £35 million at the end of 1913 to £153 million in 1926. The relative increase in the reserves of the Bank of Spain is even greater, namely, from 480 million pesetas to 2,557 millions."[3] Since these reserves have been built up largely by withdrawing gold from circulation, these countries could even now use comfortably a good deal more metal than they possess.

BOUNTIES FOR THE PRODUCTION OF GOLD

It may seem ridiculous that the producers of gold should ask for assistance in the form of premiums and bounties. To some persons it may seem that the production of gold ought always to be profitable. But this is not the case. As with every other commodity, the cost of producing precious metals varies from place to place, and even from mine to mine. Even now, in many parts of the world where gold is known to exist, the owners of the property cannot produce the metal at a profit; and many of the older mines have been abandoned because the operators could not compete with more productive sources.

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[3] *Europa,* 1928, p. 60.

In fact, operators in many parts of the world were faced with this situation on an aggravated scale from 1919 to 1924, and at the present time, the only hope of maintaining production at many sources is the discovery of means of reducing the cost of production. The high rate of dollar exchange during, and immediately after the War put the American gold producer at a serious disadvantage, compared with operators in several other parts of the world. Based on a purchasing power of $20.67 in 1914, the average for the five years from 1915 to 1920 declined to $13.85. Under these conditions, production at many of the mines was not only unprofitable, but in some instances it was a losing venture; gold production in the United States declined during this period. Many mine operators recommended a premium on production, as one method of saving the situation.

The temporary advantage which operators, particularly in the Transvaal, enjoyed, due to the rise of American exchange, was soon lost in the increase in the cost of production at all the South African sources. Production at these mines declined also. Confronted with these unfavorable conditions, the producers of South Africa called upon their government for assistance. They maintained that with the advance of the costs of labor, material, shipping, and insurance only the low-cost operators could make a profit. The plight of the gold miners throughout the world is shown in the fact that the output in 1920 was smaller than in any year since 1903. This is shown in the appended table.

Gold Production in the World, 1901-1920

Year	Production	Year	Production
1901	$260,800,000	1911	$459,300,000
1902	298,800,000	1912	474,300,000
1903	329,400,000	1913	462,600,000
1904	349,000,000	1914	451,500,000
1905	378,400,000	1915	473,100,000
1906	405,500,000	1916	454,100,000
1907	411,200,000	1917	419,400,000
1908	443,400,000	1918	380,900,000
1909	459,900,000	1919	365,100,000
1910	454,200,000	1920	338,000,000

Neither the American nor the British government was willing to give assistance in the form of a bounty. In fact, in both cases, it was thought that this remedy would aggravate the evil it was designed to cure.

There are indications that gold mining is entering a new phase in practically every part of the world. At all the great sources, gold was formerly worked under pioneer conditions, where the best material was developed first. In most cases the original abundance has been exhausted. There have been no great discoveries for a number of years; and the problem of the immediate future seems to be to discover more effective methods of working higher-cost reserves. This will impose increasing difficulties on the relatively small operator in the high-cost areas. Possibly, in the absence of new discoveries, the more productive of the present properties will be concentrated more and more in the hands of a relatively few producers who can command the capital for extensive improvements.

SILVER

This metal has also been used extensively for coinage, but with the decline in value since the great American discoveries, silver, in many countries, has been reduced to a minor position, and now serves the money purpose as token, or subsidiary coin. But at that, coinage throughout the world absorbs large amounts. The United States was nominally under bimetallism for about eighty years, but there has been no free coinage of silver since the Coinage Act of 1873. The Bland-Allison Act of 1878, and the Sherman Act of 1890, merely provided for the purchase of a certain amount of silver annually, and for coinage under certain conditions, but not for coinage on the same basis as gold. Many countries now buy the silver needed for money purposes. During the late War, international trade conditions caused a great revival in the monetary demand for the white metal. Many countries hoarded gold and prohibited its export, and silver partly replaced gold as a circulating medium. A complicating factor was the unfavorable trade balances of the United States with some of the Far Eastern countries, and the rise of oriental exchanges.

To meet this situation, the United States provided for the melting down of a certain amount of silver held in the Treasury, not in excess of $350,000,000, and the withdrawal of silver certificates which had been issued against this silver. The Pittman Act of 1918 which was the authority for this procedure provided, also, for the purchase of a new supply of metal to replace that which had been melted down.

Silver is still the standard coin in some of the poorer countries. Large amounts are used in China, and India has long been a great consumer of the metal both for coinage and in the form of ornament. Recent arrangements for the establishment of the gold standard in India will probably affect the silver situation not only in that country, but in all the silver-producing regions.

A considerable proportion of the annual production of silver is manufactured into tableware and into silver plate. Some of the compounds have extensive use. Due to the fact that some of the silver salts are readily affected by light they are employed in the manufacture of photographic materials. Silver nitrate is used in the manufacture of indelible inks and for silvering the backs of mirrors.

RELATIVE VALUE OF GOLD AND SILVER

The price of silver in fine ounces in London in 1860 was $1.352. The price has never since equaled this figure. In fact, it declined almost continuously to $.519 in 1915. The price rose rapidly during the War period, reaching the highest point in 1920 when the price was $1.346 an ounce.

The great development of silver mining in the United States, beginning shortly after 1860, brought about violent changes in the value relation of silver to gold. For almost a century the value relation of the two metals had not been far from 16 to 1; but with the increase in the output of silver it changed to 16.64 to 1 in 1875; to 33.33 to 1 in 1900, and to 39.84 to 1 in 1915. Coming at a time when agriculture in the United States was depressed, the great flood of silver was made the basis of demands for monetary reform in which silver was to be restored to equal coinage privileges with gold, on the old ratio of 16 to 1. This agitation continued from about 1875 until the coming of widespread prosperity among the farmers about 1900.

The amount of silver produced in the world during the forty years from 1860 to 1900 was almost equal to the total world production during the 307 years from 1493 to 1800. In actual figures, production during the first period just named was 3,723,600,000 fine ounces, and during the other period, 3,764,800,000. This great increase represents primarily the new American contribution to the world supply.

Silver is produced in many places in the world. In fact, more than forty countries now report production; but North America produces about 70 per cent of the world total. Mexico ranks first, followed by the United States and Canada. In South America, Bolivia, and Peru are the most important producers. The total output in 1927 was estimated at 251,000,000 ounces, of which 59,000,000 ounces were produced in the United States and 102,000,000 in Mexico. A considerable amount of silver is produced as a by-product of certain other mineral industries.

PLATINUM

Platina del Pinto, or "little silver," was first discovered in the washings of the River Pinto in Colombia, South America, about 1735. Although the metal has a very high melting point the Spaniards learned the art of fusing it, and worked it into various ornaments such as buckles, snuff boxes, and sword hilts. Strangely enough—when one considers the present high value of the metal—it was once used as a counterfeit for gold. Spanish doubloons containing platinum with a thin coating of gold were successfully passed for gold coins. Similar counterfeits are known of the $10 and $20 gold pieces of the United States. Russia employed the metal for coinage during the years from 1828 to 1845, but the difficulties in minting the hard metal with a high fusion point militated against this use. While to the eye platinum has the appearance of silver, it is much heavier than the other white metal, and what is now more important, it is much scarcer—a fact which probably makes it more desirable for jewelry, and partially accounts for its high value.

Platinum has a number of industrial and scientific uses, but because of the very limited supply the amounts consumed in these ways are necessarily limited. Due to its resistance to the action of most chemicals, and to its high temperature of fusion, it is often used in laboratories in the form of foil, crucibles, wire, and other utensils. Retorts of platinum are used in the concentrating and distilling of sulphuric acid.

One of the most remarkable phenomena connected with platinum is the large amount of jewelry which the manufacturers can produce from such a small annual supply of raw material. In the early part of 1927 there were only 64,200 ounces in the hands of domestic refiners, and this was the largest amount in ten years. During the last twenty years the annual production of the world has rarely exceeded 300,000 ounces, and since 1915 it has been much less. Colombia in South America, and the Ural Mountains of Russia, are the largest producers. Platinum was discovered in the gold mines of Dakovlov in the Urals in 1819, and the rich deposits of Nizhne-Tagilsk came to light about 1825. In normal times, before 1914, the Russian output ranged from 250,000 to 300,000 ounces a year, and that of Colombia from 6,000 to 18,000 ounces. Small quantities are produced in a few other countries, often as a by-product in the production of other metals. During the years from 1910 to 1920 the United States produced on several occasions about 700 ounces a year.

Platinum as found in the native state is usually associated with other rare elements, such as palladium, rhodium, osmium, and iridium. The ingenious chemist of today has found a limited use for some of these materials. Palladium, for example, is used in the production of automatic gas lighters; in the spongy state the element has a remarkable power of absorbing hydrogen rapidly with a marked increase of temperature. Iridium alloyed with platinum is used as a tip for the more expensive gold pens, and rhodium finds a use in the construction of electrical pyrometers.

PRECIOUS STONES

We have pointed out on several occasions that one of the conspicuous features of the present social organization is diversified consumption. This is nowhere better illustrated than in the demand for precious stones. It is not always easy to locate the motive which is latent in the demand; in fact, several motives are often combined. It is sometimes the desire for ornament or distinction or esteem. Conspicuous consumption often plays a part, and rivalry is not infrequently involved. With some persons, the dominant motive is the accumulation of a treasure in what is thought to be an imperishable form, with respect to both value and material. For centuries, superstition played an important part in the demand for jewels, and this is not infrequently compounded with religious sentiment. Biblical lore is rich in the traditions of precious stones, and it is natural that some gems should be associated with certain religious ceremonies, if not with worship itself.

But whatever the motive, demands for these articles are forces which lead to the exploration of the earth. They are a motive for building up business enterprises, for the organization of industries, and for the investment of large sums in the resources which contain these precious stones. The huge investment in the diamond industry, and the great organization constructed by operators and merchants for the marketing of these products are two illustrations of this point. Thus the enterprise which is engaged in the production and sale of such commodities is a part of our economic organization, which includes not only a nation, but since these materials must be obtained in every part of the earth, many regions and nations.

A rich folklore and many superstitions have gathered about many of the gems. The value often rests on sentiment. Precious stones are "identified with many religions, but most of them are black with superstition,—its origin generally obscure." [4] All kinds of power have been attributed to gems, some curative, some talismanic, others supernatural. The amethyst, as its name implies, was thought to have the power of warding off drunkenness. The agate is the emblem of health and wealth. The agate of India is said to render the owner eloquent and prudent, amiable and agreeable. Amber was believed to be good for stomach ache, fits, scrofula, and jaundice. The diamond was believed to cure insanity, but not in all cases, for in Burma it was supposed to be a poison akin to arsenic. The emerald stopped hemorrhages, and it had the added virtue of alleviating fevers, and of strengthening and preserving the eyes. The onyx caused nightmare. Zircon stimulated the appetite, aided digestion, and absolved the miscreant from his sins. Pearls brought sorrow to all except those fitted by the proper signs to wear them. The opal possessed the same malign power, except to the favored few who were born in the right sign of the zodiac. Many of these superstitions have been preserved, although their origin has been forgotten; and they are sometimes in the background of the present demand for jewels. At any rate, in the early days, they built up a momentum of demand, which, along with power and prestige, called attention to these stones, and kept them before the minds of the people for ages.

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[4] J. Wodiska, *Book of Precious Stones*, p. 228.

The modern buyer of jewels is, of course, much more discriminating than the purchasers of former times. Specialization of kind and quality plays an important part in selecting jewels, and in the determination of their value. With the diamond the chief requisite is brilliancy, and after this quality comes color. Judged by the commercial index, the finest is the bluish white. A deep "corn-flower blue is the gem color of the sapphire. Like the ruby, it is generally marred by more or less purple or black. Emerald should be a deep grass-green. At its best it is free from a slight touch of yellow or blue . . . the gem alexandrite is a fine tourmaline-green by day and ruby-red by artificial light. The combination is rare, one or the other color being, as a rule, weak. . . . A deep royal purple distinguishes the amethyst."[5] These are only a few of the qualities demanded by the real connoisseur; the others buy according to their best judgment, which often is not very good, but it is fancy, nevertheless, which constitutes a part of the demand.

Diamonds

The diamond of ideal purity is colorless; but very few are of this character. Many have a tint of yellow, green, or brown.

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[5] W. R. Cattelle, *Precious Stones,* p. 45.

Those with a bluish cast are highly esteemed. But, at times, the diamond is found in other colors, such as red, sapphire blue, and emerald green, although these are rare.

In ancient times some diamonds may have been discovered in Africa, but the oldest known sources which have afforded a continuous supply are those in several parts of India. The Indian diamonds "are found scattered among sands and gravels, long since released from their matrix by the processes of time, carried by waters and deposited in the beds and along the course of streams and rivers in the superficial strata of the earth in the valleys. They are found, as a rule, at a depth varying from two or three feet to fifteen or twenty feet, occasionally fifty feet."[6] Several regions in India have supplied the market with diamonds for centuries.

Diamonds were first discovered in Brazil about 1727, in the Minas Geraes district, which also contains iron ore, manganese, and gold. Brazilian resources are apparently small, compared with other parts of the earth, and, moreover, the Brazilian diamond is usually small. The output of this country up to 1850 has been estimated at about ten million carats. With the appearance of competition from the South African sources Brazil has lost much of its importance, although the rise and fall of prices alternately stimulates and depresses the industry of this country.

Borneo has produced a considerable number of diamonds, although as a rule the quality is not good. Here, also, the industry has been affected by competition from the South African sources. At times, Landak in west Borneo has produced the precious stones, and this also applies to Kusan in the eastern portion of the island. Diamonds were discovered in New South Wales as early as 1851, but the mines were not systematically worked until about 1869. Diamonds are found occasionally in the placer gold diggings in British Guiana, and in various parts of the United States, as in Georgia, North Carolina, southern Virginia, Oregon, Idaho, and Arkansas, among other places, but except for an occasional find, like the "Morrisey" and "Dewey" stones, the sources are of little significance.

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[6] *Ibid.*, p. 82.

Many of our greatest discoveries come not by design but by accident. As a rule, even the inventor is not able to tell how he got the first glimmer of an idea which led subsequently to some epoch-making invention. It just "popped" into his head, but he recognized the significance and set to work. This statement contains something of the history and subsequent development of the great diamond resources in South Africa, for they experienced accidental discovery, a period of doubt as to their merit, followed by a period of investigation, and then of development. Apparently, the rough materials had been handled by many persons who did not recognize their worth. They were even compounded in the mud plaster in the walls of the farmhouses. And not until a little son of a Boer woman played with a stone of unusual attractiveness was the curiosity of anyone aroused. This

South African Railways

Diamond mining at Grasfontein, one of the many alluvial fields of South Africa

first stone, which was nothing more than a child's plaything, was subsequently sold for about $2,500.

The first discovery in South Africa was in 1867. This was followed shortly by others, including the four celebrated sources —Du Toits Pan, Bultfontein, "Old De Beers," and in 1871, the Old De Beers "new rush" on Colesburgh Kopje. This last location, which came to be known as Kimberley, was the most important.[7] These four sources have produced the great majority of the diamonds found in South Africa.

The result of competition of the rich sources in this part of the world has been that enterprise at most other sources is reduced to an occasional industry. In the course of time the owners of these properties have built up a great organization which largely controls the diamond market. "This company has probably engineered its enormous interests with a shrewdness and understanding of the world's conditions seldom equaled. For several years it held the market steady by a firm maintenance of the price of rough, stiffening it gradually by a closer assortment. Then as the effect of the enormous gold output began to give impetus to trade, it kept in touch with it by rapid advances of five and ten per cent until it became evident that the market would bear no more."[8] This syndicate is intimately connected with the De Beers Consolidated Mines. It takes the output of the mines under contract at a stipulated price, and markets the product.

Within the last two or three years the market has been disturbed by the development of the Lichtenburg Fields in western Transvaal, and there has been some doubt whether the purchasing syndicate which has controlled the market will be able to absorb the new product. The sales of diamonds produced in the Union of South Africa from January to August, 1927, amounted to 2,808,100 carats, valued at about $40,000,000.

Emeralds

The emerald is the rarest of the beryls, and when it exists without flaws it is the rarest and most valuable of the precious stones. The early Spanish explorers in South America found considerable quantities of these stones in possession of the natives. The deposits in Colombia, South America, were discovered in 1555, and were worked by the Spaniards as early as 1558. This country still produces the best quality of these stones. Emeralds were discovered in the region east of Ekaterinburg, in the Ural Mountains of Russia in 1830. The quality, however, is much below that of the Colombian product. Stones of inferior quality have been found, also, in other parts of the world, as in Austria, near Snarum in Norway, in New South Wales, and to some extent in North Carolina.

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[7] *Ibid.*, p. 89.

[8] *Ibid.*, p. 95

The aquamarine belongs to the same group as the emerald. The two stones are alike in "composition, crystallization, hardness, and specific gravity," but they differ with respect to the fact that the crystals of the aquamarine are large and free from flaws. This stone has been found in a number of places, including the Ural and Altai Mountains in Russia, in Brazil, and in India.

Rubies and Sapphires

Small differences in composition—sometimes minute differences—often determine whether or not a stone is a gem or merely a crass product of nature. The ruby and sapphire are frequently known as the "corundums." But common corundum has little or no value in the jeweler's art, although on account of its hardness it is employed to some extent in the mechanical industries. It is used for bearings for fine machinery, in the manufacture of electrical supplies, and as jewels for watches. The ruby is a red stone, while the sapphire exists in various colors, although the article of trade is usually blue, shading down to a stone without color. Rubies occur in Burma, Siam, Ceylon, Afghanistan, Tibet, Australia, and occasionally ruby crystals are found in North Carolina. The sapphire is a product chiefly of Siam, Burma, Cashmere, Ceylon, and Australia. In all cases the quality of the stones varies from locality to locality. The sapphires of Siam are considered the finest; as a rule those of Burma are too dark, while the Ceylonese product is too light. In the case of the ruby, the stones from Burma seem to be most acceptable to the trade; those from Siam are usually dark; the product of Ceylon is light rose or pink. Varieties of fluor spar sometimes serve a purpose in the jewelry trade as "false" rubies, emeralds, or sapphires.

Pearls

It is hard to believe that the cold, scientific definition given in the following words is a description of the beautiful pearl of the jeweler's trade, but this is the fact: "It is formed by the secretions of a mollusk or shell-fish which forms lustrous concretions of carbonate of lime, inter-stratified with animal membrane. . . . A parasite or foreign substance within the shell becomes surrounded by a soft, jelly-like material enclosed in a sack. This gradually hardens, and is later covered by concentric layers of nacre."[9]

Pearls vary greatly in size, appearance, luster, and, of course, in quality. The largest article of this kind is in the Beresford Hope collection in the museum at South Kensington, London. It weighs about three ounces and is about two inches long. The chief source of pearls is the pearl oyster of the Indian and Pacific oceans, and of the Lower California and Australian coasts.

Other Precious Stones

Many other materials, more or less scarce, are used in the jeweler's trade. The demands of taste and fancy are no less exacting than those of industry, and the merchant must display a diversified assortment of goods to satisfy the tastes of his trade.

It is not possible to discuss all these materials but we may refer briefly to the amethyst, which is a form of crystallized quartz, found in Siberia, India, Brazil, Uruguay, and the United States; to the opal which occurs in Hungary and Australia, and certain varieties of which are found in Mexico, Honduras, and the United States. We should mention, also, the turquoise which is found in New Mexico, Arizona, Nevada, and California, and the topaz from Brazil, Russia, Saxony, Egypt, Bohemia, and the United States. Jade is highly esteemed by the Chinese. It is often worn as a charm because of the belief that it wards off certain diseases. Jet was once highly prized as an ornamental substance. Jewelers have use for the moonstone, the garnet, and for amber, agate, and onyx. So far as sources of raw materials are concerned, practically the whole world is the realm of the agents who supply this trade.

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[9] *Ibid.*, p. 150.

QUESTIONS

1. Which are of greater importance for industrial and social progress, gold and silver or iron and copper? Why?
2. What industrial and commercial functions can you assign to gold and silver?
3. Could modern business be conducted without large supplies of these metals? Why?
4. Explain how gold provides "enormous economies in methods of trading."
5. How does gold in the form of bank reserves "multiply many times the credit transactions based upon the dollar"?
6. What is the industrial significance of the use of gold as a store of value?
7. In what ways has gold contributed largely to the progress of modern civilization?
8. Explain how gold has been a factor in promoting discovery and exploration. What regions have been opened under this influence?
9. Why does not the great increase in the world's stock of gold produce a great rise in prices throughout the world?
10. Does it appear from present conditions that the production of gold is not keeping pace with the world's commercial and industrial needs? Why?
11. Since gold is the standard of value in many countries how do producers of gold know whether production is profitable or unprofitable?
12. Would it have been a wise policy in 1919 and 1920, or at any other time, to have granted a premium to stimulate the production of gold?
13. Gold mining throughout the world is entering a new phase. What are some of the characteristics of this new phase?
14. What is meant by the term "bimetallism"? Can you make out a case for bimetallism as against monometallism?
15. Account for the changes in the relative value of gold and silver during the last seventy years.
16. What regions are the chief producers of platinum?
17. Which are the most valuable of the precious stones? Why are these more valuable than other precious stones?
18. What motives are involved in the consumption of precious stones?
19. What regions are the chief producers of diamonds? Explain how the diamond market is controlled.

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CHAPTER XII

QUARRY AND OTHER PRODUCTS

In the preceding chapters we have confined our attention chiefly to certain power resources and to the metals. It is evident from what has been said that, among the great industrial nations at least, business enterprise is undergoing rapid changes, and that these have had a pronounced effect on the search for raw materials. We might review several of the interesting features of this development.

LEADING FEATURES IN THE DEVELOPMENT OF THE METAL RESOURCES

One outstanding feature is the high degree of specialization in the demand for materials. This applies not only to the raw stuffs supplied by Nature, but to the demands for partly finished and for finished goods. The commodity must be adapted to the use to which it is put. Second, in some important cases, industry is now exploiting vanishing resources. This is notably the case with petroleum. This does not mean that the industrial world must shortly lose the service which this resource renders, but that there is imposed on the future the new task of finding some satisfactory substitute, and, perhaps, the discovery of methods for more economical use of the supplies that remain.

Nor is this all. A third feature is that present industry is living off the "cream" of the natural resources. Wherever it is possible, in view of the present transportation and marketing facilities, the high-grade materials are developed first; the work of exploitation proceeds thence to materials of lower quality. Thus, in this connection, the problem of the future will be to find economical methods for the development of lower-grade materials. We have seen that even gold mining faces this prospect, unless great new resources are discovered. Finally, another important feature is the extent of foreign investment in certain of these great materials. This is notable in the case of petroleum, iron, copper, lead, zinc, and some of the minor industrial metals. In some instances, the purpose of such investment is present or prospective income, but in other cases it is either to secure control over some key material, or to make certain of a future supply when the home resources are no longer adequate.

FEATURES OF THE STONE- AND CLAY-PRODUCT INDUSTRIES

These materials are usually widely distributed not only within countries, but over the world. The supplies are so abundant that there is no question about exhaustion, nor even about the conservation of the resource. There is a question about efficient use, but this is a matter of profit, or loss, to the private company which exploits the resource. Thus, "there is no possibility of actual exhaustion of any of these materials, and except locally there is no danger of such scarcity as to cause rise in price. The danger is in fact all the other way, threatening the manufacturer rather than the consumer. It would be entirely feasible, from a raw material standpoint, provided a steady demand justified the erection of sufficient plants, to produce one hundred times the amount of stone, bricks or cement now annually used, without any necessary advance in prices."[1]

In fact, from the standpoint of the producer, the real danger is overproduction. Operation requires only a relatively small amount of capital, and thus the large investment, which is a check upon the small enterprise in the metal industries, does not keep the small operator out of the production of stone and clay. Indeed, even in the United States, which is the home of big business, the quarry and clay industries are usually conducted on a relatively small scale. In this country, for example, in 1920, there were 895 enterprises producing limestone, and the total value of the product was only $52,900,000; and in the case of clay, there were 345 enterprises with a product valued at

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[1] E. C. Eckel, *Coal, Iron and War,* p. 183.

$10,086,000. In the first case the average per enterprise was about $60,000, and in the second case about $29,000.

Moreover, these products usually have very little value in large bulk and therefore cannot be consumed at a great distance from the source. Thus, such enterprises, as a rule, serve only a local need. There are some exceptions, as with the partly manufactured goods which use these raw materials, and a few commodities such as marble required for some special work, or abrasive materials, or mineral pigments, and these exceptions apply at times to imported commodities; but the amounts that move in distant trade are not large.

VARIED PRODUCTS OF THE NONMETALLIC INDUSTRIES

The raw materials from these sources are remarkably diversified, and the crude stuffs are turned into even more diversified finished products. We give in the table on page 238 the output of the leading nonmetallic substances.

In addition to this list, present industry has use for a number of other materials including sandstone, granite, limestone, basalt, slate, and marble. The annual value of these products is not large, but they serve many indispensable purposes.

Clay has been used for ages in the production of earthenware, bricks, and ornaments of many kinds. The primitive worker had no conception of the composition of the material, but he learned empirically that one material was better than another, and consequently, even at this early age, selection became a part of the art of production. Modern science has contributed to the clay-product industries not only an analysis of the composition of the substances, but a knowledge of the adaptation of materials to the production of certain qualities which both manufacturers and final consumers esteem.

Clay is now the raw product for the manufacture of many kinds of commodities. It is used not only in the manufacture of bricks and of pottery, but of draintile, sewer pipe, ornamental terra cotta, roofing and flooring tile, conduits, crucibles, and chimney pipes and tops. It is used also in the manufacture of acid-proof tanks, art and chemical pottery, insulating materials, OUTPUT OF NONMETALLIC PRODUCTS IN THE UNITED STATES, 1926

Material	*Value of Product*
Asbestos	$ 135,000
Asphalt	19,938,000
Barite (crude)	1,743,000
Borates	3,128,000
Cement	280,784,000
Clay (raw)	13,540,000
Diatomaceous earth	1,482,000
Feldspar (crude)	1,607,000
Fluor spar	2,341,000
Fuller's earth	3,356,000
Graphite (amorphous and crystalline)	220,000
Grindstones and pulpstones	1,873,000
Gypsum	46,721,000
Lime	40,800,000
Magnesite (crude)	1,201,000
Mica (scrap and sheet)	525,000
Millstones	46,000
Mineral waters	8,760,000
Phosphate rock	10,894,000
Potash	1,083,000
Pyrites	617,000
Salt	25,055,000
Sand (glass)	3,200,000
Sand (molding, building, etc.)	103,300,000
Sulphur	37,300,000
Talc and soapstone	2,111,000

and hardware trimmings, and this by no means exhausts the list.

The composition of clay varies from place to place, but the chief components are silica and alumina, with the former predominating. The mass usually contains some oxide of iron, and sometimes a little magnesia and potash, to say nothing of water, and sometimes vegetable and animal ingredients.

Brickmaking, one of the most important of the clay product industries, is one of the oldest of human occupations. The ancient producer took what Nature gave, worked it up into form, and baked it in the sun. But modern brick making has become largely a machine industry. Relatively low-grade clays may be used, but the material is given preliminary treatment. Weathering, that is, exposing the material to the action of rain and frost, improves its quality. The result is to break up the larger particles and to wash out some of the undesirable soluble matter. The material is then thoroughly mixed, molded, and burned, and it is then ready for the consumer. The method employed depends upon the kind of product to be made, and not infrequently patent processes are involved in the manufacture.

The production of white ware and porcelain is a great deal more complex, and the materials must be chosen with greater care. Both types of commodities require a large percentage of kaolin, which is a very pure white clay composed of aluminum, silicon, and oxygen in the form of a silicate. This is mixed with ball clay, flint, and feldspar, each of which plays an essential part in the manufacture. The mass is thoroughly ground in preparation for the subsequent processes of pressing, or turning or casting, whatever the particular method may require. Glazing and decorating add the finishing touches.

Sand is one of the common materials which enters into important manufactures. This product, of course, exists everywhere in the world; it is used not only in the building and foundry trades, but very extensively in the manufacture of glass. In the last-named industry it is used in connection with certain chemical compounds, the components depending on the kind of glass which the producer is supplying to the market The sand must be selected with care. Since iron colors glass, the raw material must be relatively free of this substance, although in the manufacture of bottles the presence of a certain amount of iron is no particular handicap. Glass making has become a complicated process. The great diversity of tastes and industrial needs require a similar diversification of products. Coloring is imparted to glass by the use of certain elements or their compounds. Cobalt gives a blue color, selenium is used to produce red, gold chloride gives a ruby color, certain chromium compounds produce a green or greenish yellow, and mixing or blending produces other color effects.

Many countries produce articles of clay and glass in some form. England, Germany, and France are noted for the manufacture of certain kinds of porcelain. Worcester, Delft, Dresden, Limoges are only a few of the names known to the pottery trade. China and Japan once produced a kind of ware which was highly esteemed in the market, and even today some people prize the Chinese and Japanese products because of their design and workmanship.

BUILDING STONES

These materials are also widely distributed over the world. Limestone is used for building purposes, flagging, lime burning, road making, rubble, flux, macadam, etc. Marble is not as widely distributed as limestone, but it exists in great abundance in many places. Although products manufactured from cement have largely replaced marble in many uses, the material is still employed for a number of building purposes, and in the production of art and ornamental ware. Notwithstanding the recent introduction of various substitutes, slate is still an important industrial material. Large amounts are used as roofing material; the schoolroom makes use of slate in blackboards, and slate pencils were once an important part of the equipment of every school. The plumber's trade uses slate in sinks and stationary washtubs. It is also used in the production of tile, flagging, switchboards, and occasionally for certain building purposes.

LIME

In addition to the uses named above, limestone also serves an important purpose as a flux in the smelting of iron, as a raw material in the manufacture of cement, and in the production of the lime of the builder's trade. The ordinary lime is obtained by burning limestone. The product of this process of heating is impure calcium oxide, which for building purposes is slaked by the addition of water, and then mixed with sand.

CEMENT

The manufacture of cement on a large scale is one of the outstanding features of the present industrial age. It would be just as appropriate to call this an age of cement as to designate it

Indiana Limestone Quarrymen's Association

An Indiana limestone quarry

the iron or the petroleum age. Whereas the materials for this manufacture exist in great abundance in many parts of the world, the United States has become the largest producer. Demands for road building and structural work of many kinds absorb the greater part of the output, but the selling enterprise of the manufacturers is continually finding new outlets for the product. Only a few American manufactures have grown as rapidly as that of cement. In 1880 the output was only 2,000,000 barrels, and as late as 1900 it was only 17,000,000 barrels; but the output in 1926 was 164,200,000 barrels. The component parts of cement are lime, silica, alumina, together with a small amount of iron oxide and magnesia. The proportions vary with the kind of product.

COMMON SALT

No one today would venture the prophecy that the world would ever run short of salt. It is about as widely distributed as any product of Nature. Commercial supplies are obtained by evaporating sea water, or the brine from salt springs, or more largely at the present time from the deposits of rock salt.

This commodity has exerted a tremendous influence on the history of man and industries. It is an indispensable article of consumption for both men and animals. It was one of the earliest articles of trade, and the word "salary" suggests that it was used at one time as a kind of money. At any rate, it has exerted a considerable influence in the localization of settlements in the various parts of the world. The framers of the first constitutions of many of our states regarded salt of such importance that they set aside by constitutional provision a certain amount of land to be used for the purposes of the salt-makers. The first settlers in the Mississippi Valley observed great trails worn by the animals in their quest for salt; and in this connection, Senator Thomas Benton of Missouri once proclaimed the buffalo the first civil engineer, because the animal trails came to be the routes of bridle trails, and eventually of railroads.

In many places in the world the product is still obtained from sea water. In some communities along the Mediterranean this water is allowed to trickle over brush or crude lattice work; thus the solution is concentrated to some extent, and is then evaporated in shallow pans. The process of evaporation varies from place to place. In warm countries, and sometimes in very dry regions, salt water is poured into shallow pans, and evaporated by the heat of the sun. In some colder regions, sea water is allowed to freeze in pans, the coating of ice is removed, and this process is repeated until the brine is sufficiently concentrated to evaporate with heat.

While sea water, or the brine from salt springs, is still a source of supply for many communities, salt is now obtained in a number of countries from rock salt. Large deposits occur in the United States, Austria, Germany, Spain, and other parts of the world. The method of extraction is relatively simple. Wells are sunk to the deposits; and fresh water is pumped in, or allowed to flow in from some natural source; the saturated brine is then pumped out and the salt is extracted by one of several processes of evaporation. In some cases the rock salt is mined like any other mineral product.

Ewing Galloway

Salt evaporation fields at the Great Salt Lake, Utah

Salt has been used as a preservative for centuries. It is still used largely in the preparation of certain classes of meats and in the dairy business. Chemical, and other manufacturing industries, are also large consumers. It is the starting point in the manufacture of a number of chemical compounds. Producers of pottery use the commodity to produce the glaze on ordinary earthenware or stoneware; and it is used in the tanning business, and in the wet extraction of copper and silver from the ores.

The United States is by far the largest manufacturer of salt. Since it is an important material in the meat-packing and chemical industries, to name only the most important, the output has increased along with the demands of these industries. Production in 1880 was about 834,000 tons. It was more than 7,300,000 tons in 1926.

SODIUM NITRATE

This is one of the characteristic products of Chile, and the largest item in her export trade. In fact, for all practical purposes, Chile is the only source of the world's supply of this material. The "origin of these deposits is veiled in uncertainty. Just how or why the natural forces, which elsewhere as a matter of universal observation have been seen to oppose both the formation of nitrogen salts and the accumulation of such as do manage to form, should have failed in this particular instance remains wholly conjectural. . . . In the case of nitrogen they are unique beyond comprehension, and the prospect of recurrence is to precisely the same degree unlikely."[2]

The beds are located in the northern part of Chile and extend from the Camarones River some 450 miles south to the port of Caldera. The distance from the sea varies from 15 to 93 miles. The nitrate is not in a pure state, but is mixed with clay, gravel, sulphate of soda, common salt, and some of the salts of iodine. Deposits are near the surface. In exploiting the resource, the operator must penetrate at least three strata: The upper, or *chuca,* consists of surface accumulations. The second layer, or *costra,* is of firmer consistency and harder to penetrate. The real deposits are found in the third layer, the *caliche.* The composition may range from about 7 per cent to almost pure nitrate. Below is a fourth layer composed of rock. The operator bores a small shaft to the fourth layer, and inserts a charge of dynamite; the raw product is then collected and taken to an establishment for refining in preparation for the market.

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[2] J. E. Spurr, ed., *Political and Commercial Geology and the World's Mineral Resources,* p. 423.

Various estimates have been made of the extent of the supply. A survey of the fields in 1908 placed the remaining deposits at about 1,600,000,000 tons. Subsequent estimates have placed the supply as low as 225,000,000 tons.

Philadelphia Commercial Museum

Crystallization tanks at a Chilean nitrate refinery

The beginning of the industry dates back to about 1830. For some years England took the entire output and, subsequently, English capitalists became the dominant influence in the development of the industry. Later German and American capital were invested in the business. The nitrate region was obtained from Bolivia as a result of the war from 1875 to 1881, and this area is still a basis of contention between the two countries. In yielding this area Bolivia not only lost her only outlet to the sea, and the larger portion of the nitrate beds, but she lost also the prospects of a large annual source of income. In

1923 the export tax on nitrate brought a revenue to the Chilean government of 75,813,000 Chilean gold pesos. Exports from Chile in this year amounted to about 22,600,000 metric quintals, of which 12,000,000 quintals were sent to Europe, and 9,000,000 to the United States.

Sodium nitrate has many uses. It enters into the manufacture of explosives, of glass, dyestuffs, and enamelware; large quantities are used in the production of nitric and sulphuric acid, and other chemicals. Its use in the manufacture of fertilizers is rapidly growing in importance. Sodium nitrate is one of the components of a complete commercial fertilizer, the others being potash and certain compounds of phosphorous. Plants extract certain elements from the soil and the land is exhausted in time if these elements are not restored either by natural processes —the decay of vegetation, etc.—or by the use of manufactured fertilizers. A community which depends upon the soil for a large annual product cannot afford to wait for the slow natural restoration, and hence, the chemically prepared product affords a quicker process. In view of the fact that agriculture in many of the densely populated parts of the world has exhausted the original fertility, restoration by a more or less mechanical process now becomes a great necessity.

USE OF ATMOSPHERIC NITROGEN

There is no danger that the world will be in want of nitrogen for the manufacture of fertilizers. The atmosphere supplies an inexhaustible abundance of raw material in the form of nitrogen. One remarkable feature of the present age is the persistent search for substitutes for natural products, and with respect to nitrogen the experiments have yielded notable success. Foreseeing the ultimate exhaustion of the natural nitrates, Sir William Crookes suggested in 1890 that enormous supplies could be obtained by converting the nitrogen of the air into appropriate compounds. Some of his own experiments pointed a way to the solution of this problem. This work has now been put on a commercial basis. The industry is carried on successfully in Norway, Sweden, and Switzerland, where cheap water power is available, and within the last years or so, a large American company has begun the erection of plants for such manufacture. At the present stage of development, the industry must depend on cheap electrical power generated from waterfalls. It will be recalled in this connection that our Congress has often debated the question of supplies of nitrates using the Muscle Shoals power site for the location of manufacture. One of the most recent proposals involved an appropriation of $150,000,000 for the erection of plants to be owned and operated by the government.

POTASH

This term has been used loosely to indicate any of the salts of potassium. Minerals containing potassium are widely distributed over the earth, but sources from which potash can be produced on a commercial scale are not numerous. Hitherto, Germany has produced the greater part of the world supply. The Stassfurt area contains enormous deposits of material which may be worked easily and cheaply. In fact, this region alone is said to contain enough potash to supply the world at the present rate of consumption for more than two thousand years. But, of course, this rate will increase, and perhaps much more rapidly in the future than in the past. The needs of the fertilizer industries alone will require much larger supplies; but, at that, other abundant resources are known to exist.

In 1904 great deposits were discovered in southern Alsace. More recently important discoveries have been made in Spain and Tunis. Foreign capital has recently become interested in the exploitation of the Dead Sea in Arabia, and in potash concessions in the Ural Mountains in Russia. Until the present time, the great abundance of German supplies discouraged exploration in other regions, but since the War several countries have become interested in discovering local resources. Our Congress recently made an appropriation to finance the exploration of possible American sources. Surveys in New Mexico and west Texas have revealed potash-bearing minerals, but not in sufficient quantities to meet competition from the imported products. However, production in the United States now supplies 10 per cent of domestic needs. The largest production is at Trona Lake, California, and the second largest is at Baltimore, where the product is obtained by distilling waste.

In 1927 about 95 per cent of the world supply of potash was produced in Germany and Alsace. Germany produced about 1,200,000 tons, and Alsace 380,000 tons. Poland produced 15,000 tons and Spain 25,000 tons.

Upwards of 90 per cent of the annual production of potash is consumed in the fertilizer industries; but various compounds of potassium enter into the manufacture of products for bleaching fabrics, oils and fats, glass, chrome tannage, shaving and toilet soaps, and matches, to say nothing of their use in the production of pharmaceutical, photographic, and metallurgical materials. The nitrate of potassium is an important constituent in gunpowder.

The development of the German potash industry owes much to the experiments of Justus von Liebig. Even before the time of this scientist, agricultural authorities advocated the liming and marling of the soil to increase its productivity, and some of the colonial farmers of New England fertilized their hills of corn with fish—a method which they had learned from the Indians. And as early as 1660 Sir Kenelm Digby advocated the use of saltpeter in the production of certain kinds of crops. But the studies of Liebig gave some definiteness to our knowledge of soil content, and the relation of this to plant life. In his reports to the British Association in 1840 and in 1842 he indicated the importance of certain soluble materials in restoring the soil. Until 1861 no potash was sold in Germany for agricultural purposes; but during the next twenty years its use developed rather rapidly.

As we have seen, the potash of no other place in the world can compete with the low-cost product of Germany. This fact, taken in connection with the limited area in which the deposits occur, has facilitated the development of monopoly control. The large profits of the first companies which engaged in the business proved to be their own undoing; other producers entered the field, and the market was oversupplied. This condition was the original incentive for agreement among the competitors. The earliest syndicate dates back to about 1889, and subsequent arrangements have brought the control down to date.

It cannot be said that these syndicates were an entire success. The combination usually made the fatal mistake of keeping the price too high; this encouraged further prospecting and investment, with the result that new competition appeared, and on several occasions it became necessary to reorganize the syndicate to take care of competitors. Moreover, the problem of allotting production among the producers has often given trouble. The agreements have been responsible for other results, namely, the search for substitutes, and the exploration of other parts of the world. Whether or not the discovery of profitable resources elsewhere will prevent monopoly control remains to be seen, for, as we have observed in a former chapter, the international agreement has become a significant feature in the combination movement.

Two methods have recently been employed in the United States to thwart the efforts of the combination. First, Congress has made a considerable appropriation to aid the search for resources in this country; and second, in 1927 the Department of Justice filed an injunction against the group of French and German producers to prevent the extension of monopoly control to the United States. It was charged in the petition that the European organization maintained an exclusive selling agency, and that the members agreed upon the price of potash sold in the United States.

PHOSPHATE ROCK

Materials containing phosphate salts are a third substance used for fertilizers. There are many natural deposits scattered over the world, but the most important are in America. Florida, South Carolina, Tennessee, and Kentucky contain extensive supplies, and the same remark applies to Montana, Idaho, Wyoming, and Utah. The total reserves of phosphate rock in the United States have been estimated at between five and six billion long tons. Great deposits exist also in Tunis and Tripoli, and possibly in Russia, and resources of minor significance are found in many other places. Production of phosphate rock in the United States in 1926 amounted to about 3,200,000 tons. The industry is centered chiefly in Florida and Tennessee.

There are other sources of fertilizers of varying importance. The guano beds—the product of the excrement and carcasses of sea fowls—scattered along the western coast of South America, and in certain places in South Africa and Australia, contain nitrogen, phosphoric acids, and occasionally potash. The basic slag, or phosphate slag, of the blast furnaces has been a source of large production in England, Germany, and France, and to some extent in the United States. The list should include the ashes of cotton hulls, seaweed, peat, marl, crude fish scrap, and sewage. And in some respects there is no adequate substitute for the product of the barnyard.

GUANO DEPOSITS

The guano beds are one of the most unique features in the supply of fertilizers. No attention was given to this material in Peru before 1840, but when the value was recognized this country declared the deposits state property. On some of the islands, before exploitation began, the accumulations were more than two hundred feet deep. In referring to the origin of this material Mr. W. E. Dunn says in a recent publication of the Department of Commerce:

> The guano industry is due to a chain of fortunate circumstances. In the first place, the cold Humboldt current creates temperature conditions along the coast favorable for the propagation of untold millions of fish. These fish serve as food for the birds from which the guano is derived. The rainless climate makes possible the preservation of the deposits almost indefinitely. The chief guano-producing birds, in the order of importance, are the cormorant or "guanay," the pelican or "alcatraz," the lancer or "piquero," and the blue-footed booby or "camanay." Other minor species also have some importance in the aggregate. These birds follow the dense schools of fishes found along the coast, which they prey upon by wonderful exhibits of diving.[3]

Peru now uses all the guano to satisfy national requirements, with the exception of small quantities marketed by the Peruvian

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[3] W. E. Dunn, *Peru,* Commercial and Industrial Handbook (U. S. Department of Commerce), pp. 209-210.

Corporation. Peruvian farmers place orders a year in advance so that the annual requirements may be determined, and sale is permitted only to bona fide farmers. The sugar- and cotton-planters along the coast are the largest consumers, although the demands of the farmers in the interior are on the increase.

SULPHUR

This element is found in the native state in many regions. For years Sicily was the chief source of supply, and subsequently large amounts were obtained from Japan, India, and the Chilean Andes. Pyrite, another source, is also widely distributed, Spain, Norway, Portugal, France, Italy, Germany, and the United States being the chief producers. Large quantities of native sulphur have been discovered in the United States. At one time Louisiana was one of the chief sources, but Texas now supplies practically the whole output. A number of methods are employed to separate the element from rock and other impurities, but one of the most interesting is the use of hot water to melt the sulphur in the beds, and of compressed air to force the molten sulphur to the surface.

Sulphur extraction by means of hot water

Sulphur and its compounds are among the most important commodities of commerce, and, on the other hand, they are, under some conditions, the most troublesome substances with which man has to deal.

> From volcanoes to eggs or mustard spoons seems a long step, yet the blackened surface of a spoon which has been used for eating eggs is due to the sulphur in the yolk of the egg, and for the blackened mustard-spoon the sulphur of the yellow mustard is responsible. The tarnishing of silver or copper comes largely from the sulphur commonly present in the air of the house. Most coal contains some sulphur, and, generally speaking, the poorer the coal the more the sulphur, so that the leaking gases from the kitchen stove or the furnace send out sufficient of the element to tarnish any of the metals which readily combine with sulphur that may be near. Moreover, coal gas, the ordinary illuminating gas, adds its quota of sulphur in combination to the air of any room where the gas burns. White lead, the commonest of all white paints, is blackened by sulphur and lead sulphide is formed.[4]

In spite of this indictment, modern industry could scarcely exist without sulphur and its compounds. "It is a part of our daily foods, builder of our body cells, essential part of two great acids and their compounds, incorporated in the rubber that serves a thousand purposes, destroyer of germ life. . . . All in all, sulphur ranks with the greatest of the non-metals. Few elements do more to serve mankind."[5]

Sulphuric acid is not only one of the greatest materials in the chemical industries, but it is consumed for many purposes in general industries. The dioxide of sulphur is used in the bleaching of straw, silk, and wool. The "sulphite process" for the manufacture of paper depends upon the element. Refined sulphur is consumed in the vulcanizing of rubber, and the element is used in the production of gunpowder, although this commodity is declining in relative importance, due to the discovery of other more effective explosives.

GRAPHITE

As with other materials, the quality of graphite must be more or less exactly adapted to the demands of consumers. A poor grade of material may be used in the manufacture of cheap lead pencils, but for the better products some crystalline graphite must be used. Producers of lubricants must have a type of graphite which is free from gritty materials, and a high-grade product is necessary also for the manufacture of crucibles. In one form or another, graphite is a raw material in the production of stove and shoe polish, of paints, dry-battery filler, foundry facings, and electrodes.

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[4] H. Godfrey, *Chemistry*, p. 196.
[5] *Ibid.*, p. 203.

A considerable proportion of the world supply is now produced in Madagascar, where the low cost of production is an advantage. Ceylon is also an important source. In 1927, the United States imported about one-third of the output of Madagascar. Graphite was also imported from Ceylon and Mexico. Only a small amount of the natural material is produced in the United States, chiefly in Texas and Alabama; but more than 21,000,000 pounds of artificial graphite were manufactured in this country.

As with the metals, the nonmetallic group supplies a great variety of other substances, sometimes in rather small quantities; but regardless of quality or value, these materials often play an important part in the economic system, and a far-reaching reorganization would be necessary if we were compelled to get along without them. This is apparent with sulphur which, in some of its manufactured forms, penetrates a vast number of industrial activities; but it is true to some extent of asphalt, borax, gypsum, and other substances.

QUESTIONS

1. Outline and discuss briefly some of the leading features in the development of the mineral industries.
2. Which natural products would you designate as "vanishing resources."
3. Is it true that we are now living on the "cream" of the natural resources? Give the evidence.
4. Must we look forward to higher cost of production of most mineral products, and consequently to higher prices? Why? Is there any development that might offset this increasing cost?
5. Explain how the clay-product industries have been influenced by the development of modern science.

6. Name some of the most important clay-product industries. Why have clay products become so diversified? Would not a few simple wares serve the purposes of society as well as the present great variety? Why?

7. Account for the rapid growth of the cement industry.

8. Salt has exerted a "tremendous influence on the history of men and industries." Give examples.

9. What region of the world is the chief source of sodium nitrate? What is the future of the industry in this region?

10. Do you think that the development of industries to manufacture nitrates from atmospheric nitrogen will destroy the natural nitrate industry? Is there anything unusual in a new discovery or invention driving an older industry out of existence? Can you give other examples?

11. Do you think that it is possible to stabilize or balance industrial conditions? What effects do inventions and discoveries have on the stability or balance of industries?

12. Where are the largest known sources of potash? What are the uses of this substance?

13. Discuss the attempts to monopolize potash production in Germany. What difficulties did the monopolists encounter?

14. What are the chief sources of phosphates used as fertilizers?

15. Why is sulphur an important industrial product?

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CHAPTER XIII

CONDITIONS OF AGRICULTURAL DEVELOPMENT

Men and animals have always subsisted on the products of the soil and there is no prospect of any other arrangement in the future. But the manner of making a living from the land has changed from age to age and there is no reason to believe that the future will be any less productive of beneficial improvements than the immediate past. The soil is by all odds our greatest natural resource. It supplies either directly or indirectly practically all the materials for food and clothing, and it is the source of the great commodities used for fuel and power.

IS THE WORLD AREA ADAPTED TO CULTIVATION LIMITED?

An affirmative answer is usually given to this question. Within certain very elastic limits it is true that we cannot increase the land surface of any region, or of the world. But this is not a serious restriction on the economic activities of man. In many parts of the world land has been reclaimed by drainage and by irrigation, and much larger areas will be recovered in time. Holland supplies an interesting example of land taken from the sea; and in a number of the European countries the farmer has converted barren hillsides into productive gardens. If the American farmer has not duplicated this feat, he has at least learned how to plow the sides of the hills so that the fertility of his land, and his crops, will not be washed away. But even these examples are not of great significance, because the amount of waste land recovered in all of these ways is not large in proportion to the total land surface of the world which may be cultivated under ordinary conditions.

While it is true that no great additions can be made to land surface, it is likewise true that very great additions may be made to the product which men may obtain from a given surface. As long as the producer can win a greater volume of products from given areas it makes little difference whether the land surface may be increased or not. Of course, there are limits beyond which cultivation will not yield larger absolute returns, measured in bushels or pounds; and, moreover, in terms of dollars and cents there are limits beyond which cultivation cannot be carried with profit. But it is not often recognized that these are only relative limitations. What an area will yield whether measured in physical quantities, or in value, varies from time to time, and what is of more importance, from man to man. The returns from industry applied to the soil depend upon at least two things, namely, the character of the soil, and the character of the man who labors.

THE HUMAN RESOURCE IN AGRICULTURE

We have already devoted a chapter to this subject as applied to general industry. It may be well to consider the special application to farming. An instructive example of the operation of the human element in agriculture may be taken from a survey made by the Iowa State College, Ames, Iowa. After stating that wide differences were found among the various farms in the efficiency with which enterprises were conducted, the report continues with the following statement: "In livestock production, the efficiency varied widely. The average return for each $100 worth of feed to livestock was $197 on the 238 farms (surveyed); but some farmers secured as high as $420, while one farmer got but $82. The total return per brood sow kept averaged $188, but ranged from $478 down to $32 on the low farm. One farmer saved an average of eleven pigs per sow, while another saved but two per sow."[1]

The report stated further: "In the dairy enterprises, the average returns per cow were $85, ranging from $250 on the high farms down to $16 on the low farm. The poultry returns per hen varied from $9.37 to 21 cents. In the use of labor and equipment the farms varied greatly. On one of the most efficient farms, 143 crop acres were handled per man, while on the least efficient farm, only 17 crop acres were handled per man." [2]

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[1] *Better Iowa,* Vol. XIII No 22, p. 1.

Thus, there can be no doubt that the character of the soil is only one factor in the productivity of land, and it is not always the most important factor, except as surface upon which to work, because by careful selection of seeds, by care in the growing of crops, by working artificial fertilizers into the soil, and by the scientific application of labor with all that that means, the ingenuity of man exerts a profound effect not only on the character, but on the quantity, of the output.

These various human elements are sometimes grouped together and called "management"; if this succeeds in achieving better results than were previously attained, this management is called "efficient"; if it is otherwise it is denominated "inefficient." But, as a matter of fact, efficiency is itself a very complex quality. Some of its elements are foresight, the ability to adapt means to ends, thrift, ingenuity, inventiveness, capacity for scientific thought and action, and sometimes hard work. These elementary traits are compounded in many different ways in the person of the manager. The purpose of agricultural instruction is partly to develop certain native talents, partly to train and instruct the prospective worker. The effect on the human resource is in evidence in those countries where training has become a part of the preparation of men for work.

All this signifies that the soil can be made to yield not only a greater abundance, but a much greater variety, if thought and effort are applied to it. Nature has created a great diversity of products, but the process has been extremely slow. The modern experimenter has applied the method of conscious selection and development partly for the purpose of discovering products which are better adapted to the needs of consumers, and partly to adjust the crop to natural conditions for the purpose of obtaining a larger and better output. Luther Burbank is the most outstanding example of the human contribution, as contrasted with the natural, to the diversification of the products of Nature. It was something of a victory over Nature to have created the white blackberry, the Shasta daisy, and the gigantic amaryllis; but it was of more significance that these results could be obtained by conscious effort.

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[2] *Ibid.*

AGRICULTURAL EDUCATION

That both the quality and quantity of agricultural products may be improved by thoughtful human effort is now recognized by some of the great countries; but, unfortunately, the rest of the world is largely in the grip of tradition. One saving feature is that European emigrants into many lands have carried with them a knowledge of farm methods, and they have introduced their home crops in the lands of their adoption. The many European and American capitalistic planters throughout the world make use of scientific methods, and not infrequently employ men who have graduated from agricultural colleges.

This type of education has been one of the essential features in the development of agriculture in the United States, particularly in the last fifty years. The government has granted land with great liberality in aid of the founding and development of agricultural schools, and many of the states have made large appropriations for this work. Experiment stations are scattered throughout the country, and in late years such institutions have been established in Alaska, Hawaii, Porto Rico, and Guam. Under the Smith-Lever Extension Act of 1914 the federal government provided for coöperation with the states in the expenditures of large sums of money to bring instruction to the actual producer on the land. The agricultural societies are continually on the alert to protect and develop the interests of farmers.

A few of the Latin American countries have taken a real interest in scientific agriculture and have founded institutions for its development. Argentine and Brazil, for example, maintain a number of schools. There is an institution for the special study of vinticulture at San Juan in Argentine.

The educational idea as applied to agriculture has taken a firm hold in a number of the western countries of Europe. The prospective farmer receives instruction not only in schools, but through societies of his own creation which collect and disseminate information, and otherwise stimulate an eagerness for the new knowledge. Farmers' organizations often coöperate to buy supplies and to market farm products, and in a few cases coöperation in production of various kinds has met with success.

In England, the interest in agricultural education dates back to the latter part of the eighteenth century. A Board of Agriculture was organized about 1793 for the advancement of the farmer. Although this organization was short-lived, others of similar scope have taken its place. The Government Board of Agriculture was established in 1889, and, supplied with funds both from general and from local governments, it has been able to carry on an extensive program of education. Various institutions are interested in agricultural research, and courses in agriculture have become a fixed part of the curriculum of many schools.

A similar work is performed in France. Instruction is brought within reach of the poorer classes by work of special institutions. In Germany, scientific research into matters pertaining to agriculture and instruction of students have been a part of the regular routine of education for many years. An interesting feature in most of the countries of western Europe has been the growth of systems of coöperation, including credit unions which extend financial aid even to the small farmer.

Agricultural coöperation has reached its highest development in Denmark. In that country in 1923 "members of coöperative societies were doing 90 per cent of Denmark's agriculture; more than 80 per cent of the pigs went to coöperative bacon factories; nearly all Danish butter is manufactured and exported coöperatively. For several other purposes coöperative organization is general; a farmer will be a member of perhaps seven or eight different kinds of societies."[3]

Except for the countries named above, very little has been done in the rest of the world to develop an interest in the training of farmers. Here and there in China are a few institutions which give instruction in farm methods. The University of Nanking, and the National Southeastern University, both of Nanking, have devoted much attention to methods of acclimatization of American cotton, and to the development of native varieties by selection. This has become necessary because the plant grown from American seed deteriorates quickly if the seed is distributed direct to the farmers. The University of Nanking has achieved some remarkable results at its experiment stations; moreover, it has trained many Chinese who have been sent out to teach the farmers of the district modern methods of cultivation. The Kiaochow Bureau of Agriculture and Forestry is also spreading the idea of scientific agriculture. This institution maintains an extensive experiment station for the purpose of "improving the varieties of fruits suitable to domestic conditions, and of such industrial plants as cotton, sugar beets, peanuts, tobacco and hemp. Improvements of native domestic animals by the introduction of foreign breeds and the improving of breeds of poultry constitute a special feature of the Bureau's work."[4] Except for a few institutions, like those just cited, agricultural education in China is conspicuous by its absence, and this is true also of India. One great handicap to the development of agricultural education in many parts of the world is widespread illiteracy. For the many millions of farmers in these countries the only means of instruction is personal contact and supervision, and this, of course, is impossible.

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[3] *Europa*, 1928, p. 31.

UNECONOMIC CONDITIONS

In many parts of the world the development of agriculture is retarded not only by lack of means of education, but by the condition under which farmers must live and work. Naturally, these conditions vary from region to region. Over vast areas, poverty prevents the farmers from owning anything but simple handmade tools. In these regions, the wooden plow, the wooden-wheeled cart, and spades and rakes of wood seem to be the common equipment. This is notably the case in all the backward parts of the world, including China, India, the larger islands of the Pacific, and in practically all of South America, except Argentine, Brazil, and Chile, and many farmers in the three countries last named cannot afford to buy modern tools.

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[4] *China,* Trade Promotion Series, No. 38 (U. S. Department of Commerce), p. 751.

Publishers Photo Service

Chinese agriculture, typical of the crude methods of the Orient

The character of the machine and tools which farmers use is not always a question of their ability to buy, because topography, accessibility to markets, the kinds of crops which they produce, among other conditions, determine the kind of devices which ought to be used; but poverty is an absolute bar to the purchase of machinery of any kind.

The land system of many countries is frequently connected with the conditions just named both as cause and as effect. Small holdings, for example, are partly the result of the poverty of the farmers, but other causes, such as the traditional splitting up of holdings among heirs, is partly responsible for small farms. In some parts of the world, as in Argentine, conditions are reversed, and the large holding is frequently responsible for the poverty of certain classes of farmers. Where natural conditions make possible large-scale production, ownership is limited for the most part to those who are able to buy large tracts of land; the rest of the agricultural population is composed largely of farm laborers and tenants. Similar conditions prevail in the more highly developed portions of Brazil, as for example, among the coffee planters.

In some of the western countries of Europe the farms are probably too small for effective cultivation. In France in 1908, more than 80 per cent of the holdings were of 10 hectares or under, and this means roughly under 25 acres. As a matter of fact, about 38 per cent of the holdings were under one hectare, 2.47 acres. The disadvantages of this condition were overcome somewhat by coöperation among the farmers both in the purchase of supplies and in the marketing of certain commodities. But no system of marketing is an adequate substitute for a well-organized and effective system of production. In most cases, these small farmers were performing work by hand labor which could have been performed much better by machinery. The need of using a large amount of manual labor instead of mechanical devices is one of the penalties a country pays for achieving a wide diffusion of land ownership.

If farms in Germany are not as small as those in France, at least there are indications that ownership is coming more and more into the hands of small proprietors. Large estates have prevailed in the northeast, but in the southwest and northwest the holdings have been relatively small. Prior to the War, upwards of 30 per cent of the farms were of 50 acres and under, and about 19 per cent were 12 acres and under.

England has been a land of large estates, and this condition would probably continue if present legislation did not favor a wider diffusion of ownership. Since the rise of wheat growing in the Americas the English farmers have found it more and more difficult to hold their own in competition with the imported commodity. This competition is much more disastrous to the small farmers than to the large ones because they cannot organize their work effectively. Yet the country seems to have adopted the policy of promoting land ownership in relatively small parcels.

We have seen in another connection, that in India and China, the most densely populated portions of the world, the holdings as a rule are very small. The following description would apply to many parts of China: "Land holdings are invariably small. Farmers who are usually on the border of poverty, obtain financial assistance either by selling their crop before it is ripe or by borrowing from their market town, the latter being the common practice."[5]

In the United States in 1920 about 12 per cent of our 6,448,000 farms were under 20 acres, about 23 per cent were from 20 to 49 acres, and about 19 per cent were 175 and over. The majority of the very large farms were in the western grain and cattle area, where farming on a large scale seems to be the most profitable method. The land system of the United States more nearly approaches the ideal for effective agriculture than in any country in the world; but it must be admitted that conditions are not ideal in some areas, as among many of the tenant cotton farmers of the South. The efficient size of a farm is a matter of farm organization, and this in turn depends on a number of conditions, such as the topography of the area, the character of the industry, and the amount of capital which the farmer can command, among other things.

EFFECT OF TRANSPORTATION

Facilities for the transportation of goods over long distances are among the most important conditions for the development of agriculture. And in addition, if the products are perishable, there is need of methods of refrigerating or preserving the goods on the way to ultimate consumers. Agriculture must remain in a backward state unless these conditions are satisfied.

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[5] *Ibid.*, p. 622.

We may take an illustration from our own history:

> About the year 1805, the usual price of carriage over the country roads was stated to have been about 50 cents for 100 pounds for every twenty miles. At this rate, corn, which before 1835 rarely sold for more than 35 cents a bushel, would not stand the expense of moving twenty-five miles, even though it had been produced without cost. On the same basis, the area in which wheat could be sold at a profit to the farmer was limited to a radius of from fifty to seventy-five miles. In Kentucky, the most populous state in the West in 1805, there was not a single species of product, with the exception of ginseng, that would bear the expense of carriage by land from that state to Philadelphia.[6]

In the absence of means of transportation the markets were chiefly local, and the farmer grew no more than his family could consume, with possibly a small excess for an occasional buyer. It is obvious that this condition restricted enterprise, for there was no reason for exertion beyond that which was necessary to supply the small domestic need.

The agricultural areas of the United States, of Europe, and of Argentine and Brazil are well provided with railway facilities. Australia with about 26,300 miles and the Union of South Africa with 12,400 miles are probably well enough supplied to satisfy present needs. But in all Asia, including India and China, there are only 68,300 miles; in all of Africa, including Egypt and the Union of South Africa, there are only 20,500 miles, and in all of South America only 55,700 miles, and if we deduct the mileage in Brazil and Argentine there are only 13,000 miles of railway in the remainder of this continent. With the exception of the few areas mentioned above, the world is very poorly supplied with railway facilities, and this condition is a check upon their industrial development, including agriculture. Ocean facilities, however, with a tonnage of over 64,700,000 in 1926, were more than adequate to handle all the freight delivered at ocean ports.

GOVERNMENTAL ASSISTANCE

In many instances, governmental assistance, or the lack of it, is a condition of great importance in the determination of the agricultural status of a country. Fortunately, many of the governments of the world have recognized this fact and have adopted policies which are favorable to agricultural expansion. This service may be rendered in a number of ways. Education is of course an important means. But aid may come in the form of governmental leadership in agricultural research, in the development of credit agencies, in promoting beneficial agricultural organizations, and in the adoption of foreign trade policies to encourage and protect the farmers.

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[6] I. Lippincott, *Journal of Political Economy,* Vol. XVIII, pp. 270-271.

SOIL AND CLIMATE

In the preceding pages of this chapter we have discussed the effect of the human element, and of man's institutions on the development of agriculture. In many important respects man modifies the conditions under which the products of the field are grown, sometimes diversifying Nature's original contribution, sometimes devising ways of making natural resources more productive, and upon occasions, through a study of the conditions of soil and climate, securing a better adaptation of plant and animal life to natural conditions.

Soil, of course, is not a fixed quantity, nor is it of unvarying quality. Nature itself is constantly working changes. Rocks are breaking down under weathering influences, such as the alternation of heat and cold, and changes from moisture to dryness and the reverse. The soluble portions are washed out by rains and spread far and wide with the movements of both wind and water. Moisture enters the crevices created by prior disintegration, and the rocks are still further pried open by the freezing of the moisture. This process is repeated from year to year, and we might add from age to age, until the rocks gradually break up and yield the elements which partly support plant life. Lichens, shrubs, plants, which cling to the sides of the hills, send their fine fibrous roots into the crevices already created and add to the work of disintegration. Ants, earthworms, and rodents complete the job.

The components of the soil are distributed far and wide by wind, by floods of rivers which leave a rich deposit along the banks of the stream, and by the action of ordinary rains which wash soluble elements down the sides of the hills to be deposited here and there in the course of their descent. Over long periods, the action of glaciers has been an important means of transporting the materials out of which soils are made. Under these conditions there are enormous differences in soil content from region to region, and in some cases, from farm to farm.

The elements which plant life requires from the soil are phosphorus, potassium, sulphur, calcium, magnesium, iron, sodium, silicon, and chlorine. These must exist in some soluble form, otherwise they cannot be consumed. These elements are widely distributed in the soils of the earth, although the composition varies greatly from place to place. Practically every region which is supplied with enough moisture, and which is not frozen the year round, can produce plant life of some kind. The carbon in the plants is derived from the carbon dioxide of the air, and the hydrogen and oxygen come from the water in the soil.

The texture of the soil has much to do with its productivity. Clay soils, for example, are often nonporous and hold the moisture. They serve an important purpose in hot dry climates where moisture tends to evaporate quickly. Sandy soils are very porous; other things being equal, they are usually of advantage in cold and wet climates where rapid evaporation is necessary to carry off an excess of moisture. The presence of decayed vegetable matter often affects not only the composition, but the texture of the soil. Among other things, the plowing of the field not only breaks up the earth so that it may be more easily penetrated by the roots of plants in their quest for food and moisture, but under proper conditions, it enables the soil to store water.

Some regions have been particularly favored by the soil-making processes, the valleys which receive the washings from hills and mountains, and the alluvial borders of streams are usually very fertile. In the valley of the Po, in northern Italy, material from the Alpine slopes has been spread over the country; the delta of the Nile receives its annual supply of fine sediment deposited by the river, making this region one of the richest areas in the world. Many places along the Mississippi receive a similar advantage. Sometimes, huge quantities of dust carried by winds perform a similar function, as in sections of northern China where the original soil is buried beneath a thick deposit of fertile loess swept in by the winter monsoons from the desert of Mongolia.

As we have already seen, the work of man has often wrought profound changes in conditions which Nature originally created. Land has been reclaimed not only by irrigation and drainage, but by imparting fertility to the soil. For ages this has been done in a more or less primitive way by the use of manures which perform at least two functions, namely, the supply of plant food directly, and the change of some of the components of the soil so as to make them available for use by plants. The scientific methods of modern days have achieved even better results. The sandy plains of northern Germany have been rendered productive by scientific tillage, and similar results have been obtained with the originally unfertile soil of Denmark. In the present day this is not an unusual accomplishment for the scientific agriculturalist.

Poor soils can be made to yield good crops if properly treated.

> Western Long Island has poor sandy soil, while the eastern part has good soil. Yet the great market of New York City offers such advantages, the cost of transportation is relatively so small, and fresh vegetables can be delivered with so much less deterioration than is suffered even in cold storage, that the western end of the island contains some of the world's finest truck farms, while the eastern part is only moderately developed. It pays better to transport fertilizer and make the soil rich than to transport vegetables which lose their freshness on the way to market.[7]

Unfortunately, climatic conditions are not handled as easily as the soil. To a very large extent, man must take what Nature gives. He may study the laws of natural occurrences, but as a rule, he must adjust himself to such heat or cold, rain or drought, wind or calm, as Nature gives. These conditions bear much more heavily on agriculture than upon manufactures and commerce. In the latter cases, man has learned to overcome some of the disadvantages of climatic conditions, but the producer of commodities from the field has no means of escape. But the condition is not as bad as it seems. The natural climatic conditions over vast areas are favorable to production. Moreover, some success has been met in the production of drought-resisting and quick-maturing crops, although in such cases the agriculturalist has been far less successful in overcoming unfavorable climatic conditions, than in meeting similar conditions in the soil.

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[7] Huntington and Williams, *Business Geography,* p. 44.

If the human race has not been able to control climatic conditions it has, at least, reaped an enormous advantage from the fact that the various types of plant life require different climatic conditions. In the course of centuries each of the climatic zones has developed characteristic products. The tropics, for example, are rich in certain kinds of food products, cabinet woods, fibers, gums, and medicinal plants which do not thrive in other zones. The temperate regions, on the other hand, produce their peculiar list of products; thus, these natural differences have been the cause of a great diversity of products, and have laid a basis for trade.

An Arizona orange grove on land reclaimed from the desert by irrigation

DIFFERENCES IN CONDITIONS

One of the most significant features of agriculture over the world is the great diversity of conditions of production. This applies both to methods of production and to qualifications imposed by nature. We have seen in another connection that there are great differences in wealth among the nations. For one thing, this means that the people of some countries are better able to equip themselves with tools and machines, and make provisions for education, than others. But there are great differences also in fertility of the soil, in growing conditions, in quality of management, and in methods of production. These factors are eventually reflected in the cost of producing commodities from the field. We may take an example from the United States.

In this country, in 1925, the cost of producing wheat ranged from 96 cents on the low-cost farms to more than $3.00 a bushel. But there are surprising differences in cost even in a limited area. According to a survey of Sherman County, Oregon, about 1923, "The variations on owned farms were from $.72 to $2.47 per bushel. The average net cost to owners was $1.10 per bushel."[8]

No doubt just as great differences exist among producers within other countries, and from country to country. It is true that production advantages may be offset in whole or in part by cost of transportation to the consuming regions, but to the extent that advantages exist, they raise an important question of national policy, namely, whether a country should protect itself against its low-cost competitors by tariffs (or by grants of bounty), or whether it should adopt the free-trade principle at the expense of loss of a portion of the domestic production. Evidently, the International Commission of Agriculture, in 1926, was inclined to the latter point of view, for it recommended "free trade for agricultural products," and urged that where custom protection was maintained it should be reduced to the "indispensable minimum maintaining an equitable balance between industry and agriculture." Presumably the members of the commission were not aware of the great differences in cost from country to country; or at best, they were under the impression that these differences could be largely equalized by improvements in production. Thus the further recommendations included: "The application by the farmers of an improved technique, both in production and marketing; the further development of associations and coöperatives among holders of small and medium-sized farms; state aid for the development of coöperative credit and agricultural vocational education, and the extension of social legislation to the rural population."[9]

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[8] U. S. Department of Agriculture (Bureau of Agricultural Economics). p. 5.

QUESTIONS

1. Justify the statement, if possible, that the "soil is our greatest resource."

2. How do you account for the wide range of cost of production in the case of agricultural products?

3. Can the products of the soil be increased by good management? Do you think they can be thus increased without increasing the cost of production? Is there a limit beyond which good management cannot go in making profit by increasing the product? What determines this limit, if it exists?

4. Explain how the human resource has been an important factor in agricultural progress.

5. Explain how certain indigenous products of the field have been rather widely diffused over the world. What products have been thus distributed?

6. Name and discuss the chief conditions of agricultural progress.

7. Discuss the development of agricultural education. Estimate the importance of such work for agricultural progress.

8. What conditions retard the development of agriculture in many parts of the world?

9. Explain how the character of the land system of a country affects agricultural progress.

10. Is it a wise policy for a country to encourage the diffusion of land ownership among small holdings, that is, farms of small size? Why?

11. What conditions determine the most effective size of a farm?

12. Explain how the development of transportation has affected the progress of agriculture.

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[9] *Europa*, 1928, p. 18.

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CHAPTER XIV

THE CEREALS

That the consumption of a people becomes more and more varied with the increase in wealth is axiomatic. In fact, one of the purposes in acquiring wealth is to gain access to a larger assortment of goods. Our attitude towards foodstuffs is no exception to the rule. The demand for diversified kinds of foods is a cause for the specialization of the food-product industries and for the many kinds of agricultural activities. The requirements of household consumers, particularly if they have the money to spend, are as exacting as the needs of manufacturers. A rough classification of food products would include the cereals, vegetables, meat products, fruits, and beverages. Both farmers and manufacturers of food commodities have learned that the way to promote sales is to cater to the diversified wants of consumers, with the result that these classes of commodities are presented to the users in a vast number of forms.

RELATIVE IMPORTANCE OF THE CEREALS

The world's greatest cereals are wheat, rice, corn, oats, rye, and barley. It is impossible to rank them in the order of importance, because their uses are not the same in all instances, nor do they serve people of the same standard of living. Rice probably has more consumers than any other cereal. In fact, it occupies about the same position in the very populous areas of the Far East as wheat does in Europe and North America. But this statement needs qualification. Some rice is consumed in the western world, but the quantity is very small compared with consumption in China and India. On the other hand, considerable amounts of wheat are produced and consumed in the Far East. In 1926, for example, India produced more than 325,000,000 bushels, which is not much less than half the amount often produced in the United States. China, also, is a large producer. The usual assumption that the Chinese are a rice-eating people is far from the truth. Julean Arnold says in a recent publication of our Department of Commerce: "There are millions of Chinese who do not eat rice, and who probably have never seen rice. The population of North China, including that of Manchuria, is not, for the most part, rice-eating. These people produce and consume wheat, millet, corn, beans, and sweet potatoes, as the main part of their diet. Other parts of China, even to the extreme southern portions, consume wheat flour, and the quantities consumed are constantly increasing."[1] There is no reliable information relating to the production of this commodity, but Mr. Arnold states that the annual wheat crop varies from 200,000,000 to 600,000,000 bushels. In view of the large consumption in the Far East, and the high place it occupies in the feeding of people in the western world, wheat is by all odds the world's most important cereal.

The world produces more corn than wheat. In actual figures, the output of the former in 1926 was about 3,700,000,000 bushels, while that of wheat was 3,200,000,000. In fact the United States produces from three to four times as much corn as wheat, but this ratio does not prevail in the rest of the world. In this country corn, including both grain and stalk, is used chiefly in feeding livestock, although considerable amounts enter into household consumption. Moreover, in this country at least, corn is becoming the raw material for the manufacture of a long list of so-called corn products. In some parts of the world corn is the principal article of human diet, yet the tendency is to abandon the use of this commodity when people can afford to consume wheat. Rye is the principal bread-making product in the eastern and central portions of Europe, but it is consumed to some extent in practically all countries. Barley also serves as a foodstuff, but in many places it also enters into the manufacture of beer and whiskey. Oats, also, is used as a food product, more in some countries than in others, but it is used chiefly as a feedstuff.

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[1] *China,* Trade Promotion Series Bulletin No. 38 (U. S. Department of Commerce), p. 69.

HISTORY OF WHEAT

The human race consumed some variety of wheat long before the dawn of recorded history. The origin of the plant is thus the object of mere conjecture. It is mentioned in the oldest records, and grains of wheat have been discovered in the most ancient tombs where they were expected to feed the pilgrim on his journey to some unknown paradise. The primitive wheat was of course very different from the modern product. The original home of the plant may have been Mesopotamia, whence cultivation spread in very early times as far west as the Canaries and east to China. The plant was not known on the western hemisphere until the sixteenth century. It was introduced into Mexico about 1530 and into the English colonies of North America about 1610.

Wheat adjusts itself rather readily to changes in environment. But its character is affected by the nature of the soil in which it grows, by climatic conditions, and by hybridization. It follows from this fact that there are a large number of varieties of the plant. "In some parts of England white wheat will, in a few seasons, become red when grown and seeded on the same farm year after year, and red wheats soon become white if grown continuously on the Pacific slopes of America." [2]

The plant grows in many parts of the world, and under a great variety of conditions, although it thrives better in some regions than in others. The temperate regions of both the northern and southern hemispheres are the greatest producers, Argentine and Australia, which produce about one-eighth of the world supply, being the chief sources south of the equator. But wheat is grown in the higher altitudes in a number of the South American countries, as in Peru, Bolivia, and Ecuador, and within recent years cultivation has been pushed far north into Canada into regions where it was once supposed the plant would not grow successfully. The chief difficulty in the far northern areas seems to be early frost. After the growing in these regions has passed the "milk" stage the crop is relatively safe.[3] Because wheat is grown in so many places in the world, and under such a variety of conditions, the harvest is in progress somewhere practically the year round. Harvest time in portions of India and Upper Egypt, for example, is in February and March; in Syria and other portions of India, and in Persia, in April; in Algeria and Central Asia, in May, etc. Seed time in Argentine and Australia is in May and June; harvest in Argentine, Australia, and New Zealand is in December and January. There is considerable market significance in the fact that wheat is grown in both the northern and southern hemispheres. It is not only a partial insurance against shortage, due to unusually bad growing conditions in one or other part of the world, but it tends to give more stability to the market than if the world harvest were only for a limited period each year.

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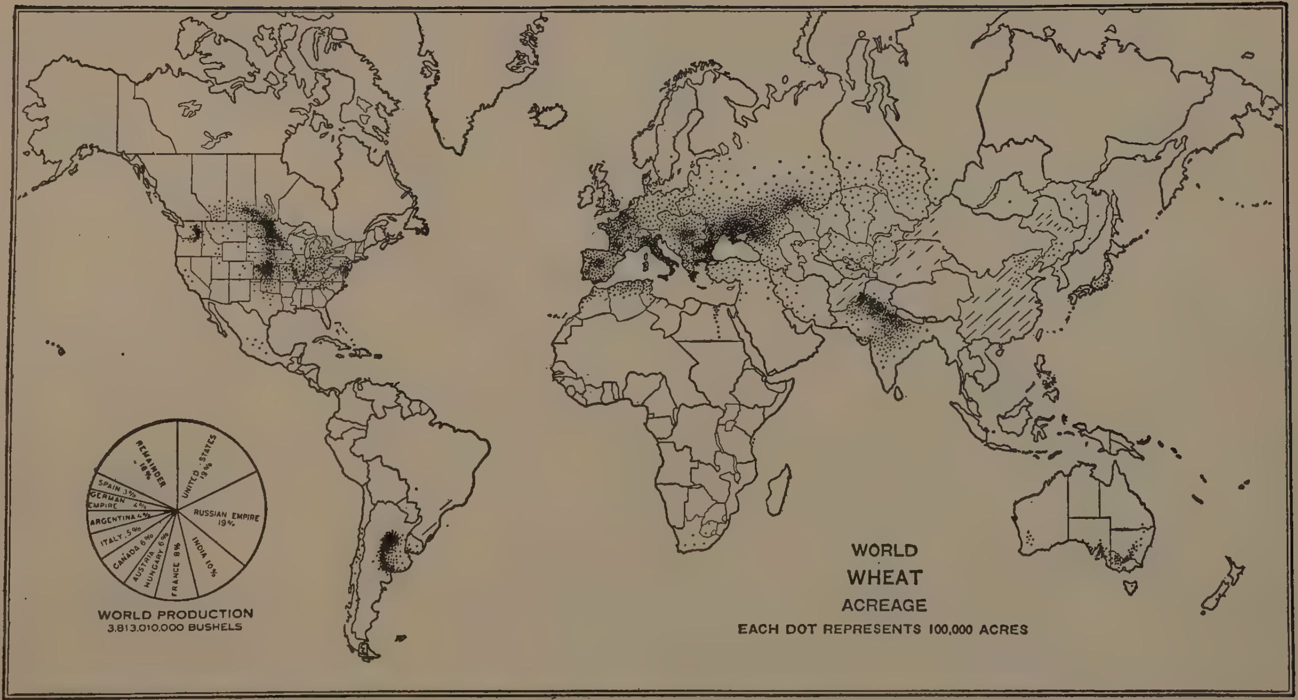
[2] A. Millar, *Wheat,* p. 2.

[3] *Ibid.*

The yield of wheat per acre varies greatly from one part of the world to another. In some cases the new land is highly productive; but, as a matter of fact, the highest yield is usually obtained in the older parts of the world under systems of intensive cultivation, such as prevail in some of the countries of western Europe. Yield is partly a matter of the industry and skill of the worker, but this return is often seriously affected by the weather conditions during any particular growing season. In the United States, for example, the yield per acre of winter wheat in 1922 was 13.8 bushels, while in 1926 it was 17.0 bushels. The return is much higher under the intensive system of cultivation which prevails in western Europe. In Belgium the yield is often as high as 35 bushels, in England 32 bushels, and in Germany about 30 bushels. But in Italy the average yield is only 13 bushels, in Argentine 11 bushels, and in India 11 bushels.

There are a number of classifications of wheat, but a very common distinction is between spring and winter wheat. The latter, as the name signifies, is sown in the autumn and stands in the ground during the winter. The botanist would not accept this division, but it serves a purpose in the trade. The class *Triticum sativum* is the ordinary variety of wheat, but there are a number of divisions and subdivisions which include the more common names, such as emmer, spelt, durum wheat, and club or square-head wheat. Polish wheat is a distinct form. As with other commodities, great care must be exercised by the miller in selecting and preparing the wheat in view of the kind of flour


WORLD
WHEAT
ACREAGE
EACH DOT REPRESENTS 100,000 ACRES
WORLD PRODUCTION
3,813,010,000 BUSHELS
UNITED STATES 19%
RUSSIAN EMPIRE 19%
INDIA 10%
FRANCE 8%
HUNGARY 6%
AUSTRIA 6%
CANADA 6%
ITALY 5%
ARGENTINA 4%
GERMAN EMPIRE 4%
SPAIN 3%
REMAINDER 16%

From Finch and Baker, Geography of the World's Agriculture

World cultivation of wheat

which he intends to deliver to the trade. The same care must be exercised in grading the flour. The demand has become highly specialized with respect to the kind of product the baker wishes to produce, as bread, crackers, pastry, and macaroni. Thus the flour must be adapted to the particular needs of the consumer.

UTILITY OF WHEAT

The importance of wheat is due to a number of favorable characteristics. Its high food value is a strong point in its favor. But, in addition, a much larger number of products can be made from wheat flour than from that of any other cereal; it is thus splendidly adapted to the baker's art. The readiness with which the plant adjusts itself to soil and climatic conditions adds greatly to its utility. And besides its genuine merits for food and culinary purposes, the market has gradually built up around wheat a prestige value, and the consumption of this cereal has come to be considered one of the indices of an advancing standard of living.

World Production of Wheat, 1926

Country	*Bushels*
United States	832,000,000
Canada	406,000,000
England and Wales	50,000,000
France	249,000,000
Spain	157,000,000
Italy	221,000,000
Germany	95,000,000
Jugoslavia	71,000,000
Hungary	69,000,000
Roumania	111,000,000
European Russia	810,000,000
India	325,000,000
Argentine	223,000,000
Australia	164,000,000

LEADING WHEAT-PRODUCING AREAS

The United States, European Russia, and Canada are the greatest producers of wheat in the world. While the output of Australia and Argentine is not as large as that of some of the other countries, it is significant because these countries have a large surplus for export. The world production of wheat in 1926 is shown in the table on page 277.

This table does not contain some of the unimportant producing areas. Taking these into account, the total world production in 1926 was estimated at 3,400,000,000 bushels. Production is strongly localized in the growing countries. Although wheat is produced in practically all the states, the wheat belt in the United States stretches westward through Ohio, Indiana, Illinois, Iowa, and Kansas. Production is also localized in Minnesota and the Dakotas, and in the southeastern corner of Oregon and in the adjoining area of Washington. The great wheat area of Argentine is in a radius of from two to three hundred miles from Buenos Aires. The greater portion of Russian wheat is grown in the southern part of the country and the exported surplus is sent out by the Black Sea ports, although at times considerable quantities have been sent out from the Baltic ports. In Canada, the central and western provinces are the chief producers. Much of the Canadian product finds an outlet by way of the Great Lakes.

EXPORT TRADE IN WHEAT

Wheat is one of the most important articles that moves in world trade. In 1926 the total shipments from the exporting countries were estimated at 751,300,000 bushels. Canada, the United States, Argentine, and Australia are the chief exporting countries; the United Kingdom, Germany, and Italy are usually the largest importers, and considerable quantities are imported by Belgium, France, and the Netherlands. The shipments from the leading exporting countries are shown in the appended table.

Exports of Wheat from the Leading Countries, 1926

Country	*Bushels*
United States	108,000,000
Canada	320,000,000
Argentine	99,000,000
Australia	77,000,000
Hungary	20,000,000
British India	8,000,000

Ewing Galloway

A California wheat harvest, reaped, threshed, and bagged in one operation

The United Kingdom imported 202,000,000 bushels this year; Germany imported 76,400,000 bushels; Italy 66,300,000 bushels; France 35,900,000 bushels; and Belgium 42,600,000 bushels. The United Kingdom, which is the largest importer, receives wheat not only from the United States and Canada, but from Argentine, Australia, India, and Russia. Indian and Russian wheat often contain dirt mixed with the grain, and in such cases it is bought with the understanding that the purchaser may make deductions if the dirt exceeds an agreed percentage.

USES OF WHEAT

By far the largest percentage of the world output of wheat is consumed in the manufacture of bread, but large quantities also enter the manufacture of candies, confections, cakes, pastry, and many articles which bakers and candy-makers have to sell. Another great source of demand has arisen during the last thirty years from the manufacturers of prepared breakfast foods. Although to some extent these new food-product industries have simply shifted the use of wheat from one product to another, the manufacture of breakfast foods has added something to the consumption of wheat.

A generation or so ago, corn meal, hominy, and oatmeal, prepared in various ways, were the most important products, but we have passed into an era of package foods which require large amounts of wheat, in addition to oats and sometimes rice, rye, and barley. These products may be uncooked, in which case they consist of ground hulless cereals, or they may be prepared by steaming or cooking before putting in the packages, or they may be malted foods prepared by causing chemical changes in a portion of the starch to make the product more digestible.

Manufacturers have exercised almost endless ingenuity in making these products attractive, sanitary, palatable, and gastronomically satisfactory.

> Among the first of the modern prepared foods were the rolled grains. These are prepared by cooking the hulless grain for some time by steam, and then, while still wet, running it between rollers, pressing it into thin flakes. After drying, it is ready for the market. . . . Some ready-to-eat brands are simply cooked in water and then dried and crushed. Some are a mixture of different grains. Some have sugar, molasses, or other carbohydrate material added to them, and some apparently contain caramel or other coloring matter.[4]

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[4] M. A. Carleton, *The Small Grains,* p. 560.

In some portions of southern Europe, consumers have long been familiar with macaroni and related products, but the use of these articles has been spreading to other countries. This type of manufacture requires special kinds of wheat. The ordinary hard spring or hard winter wheat does not serve the purpose. American producers usually consume durum wheat. Good macaroni cereals are grown in Italy and Algeria, and the durum wheats of the Azov Sea district in Russia, and the Polish product grown in southern Europe is adapted to this use. These wheats contain the pasty gluten which makes them valuable for this manufacture.

FUTURE OF WHEAT GROWING

During the War period practically all the belligerents were compelled to economize in the consumption of wheat flour. The bread of that period contained a large percentage of wheat flour with a mixture of flour prepared from potatoes, rice, and corn. Bread of this composition is more or less satisfactory in an emergency, and if the time comes when the world must be sparing in its use of wheat, such partial substitutes may be one way out of the difficulty. But considering all the cooking purposes to which wheat flour is put, there is no satisfactory substitute. One great difference between wheat and all other cereals, except possibly rye, is that its gluten is composed of two proteids, gliadin and glutenin, which impart to the flour its real bread-making value.

Notwithstanding the fact that the population of the world is growing, and the percentage of wheat-eaters—as compared with the numbers who eat rye, corn, etc.—is constantly increasing, there is no present indication that economy will be forced on us in the near future. One interesting feature of the present wheat-growing industry is that a very large part of the world supply now comes from countries which have a relatively small yield per acre. This is due partly to the fact that many growers are working relatively poor land on a large scale with power devices. But a more important reason is that a large percentage of the world's wheat is still produced under a system of extensive cultivation. To what extent the output may be increased by intensive cultivation is shown by the high yields in some of the European countries. This type of production seems to indicate greater expense, and a higher price to cover the producer's various costs. But we have by no means exhausted our resources for greater economies in production. More careful selection of seeds; better organization of the work on the farms; and more effective coöperation among producers in planting, harvesting, and marketing the crops are possible source of economies in production. In a former chapter we referred to the enormous waste in the consumption of coal, petroleum, and other mineral products. There are analogous wastes in the consumption of all food products. It is possible, therefore, to make our present wheat crop serve a much larger number of consumers by eliminating some of this waste.

Moreover, it is not only possible to increase the yield in many parts of the world, and to get rid of much of the wastes in consumption, but to increase the world acreage. Many regions in western Europe seemed to have reached their limit both of acreage and of yield; and no great increase in acreage is possible in the wheat belt of the United States, although the yield may be substantially increased. But there is still the possibility in the United States of reclaiming a great deal of land by irrigation and drainage, by the further development of drought-resisting crops, and by producing the cereal on many of the abandoned wheat lands of this country.

Expansion is possible in other parts of the world. There are still large undeveloped wheat lands in the temperate portion of South America, some of which is now used for cattle raising. Portions of Uruguay and Paraguay could be reclaimed for this purpose. And prospective wheat-growing areas include large tracts in Canada and in northern, southern, and eastern Africa. Portions of China and Siberia will eventually produce much larger quantities of wheat than at present, and additions may be made to the growing area in Australia by use of irrigation. Thus, the world has by no means exhausted its potential wheat-producing capacity. The rise of price during the past few years has caused a revival in wheat production in certain areas in England, although at the expense of the consumers, and wheat could be grown profitably in other places in the world with only a moderate increase in price.

RICE

The early history of rice is wrapped in about as much mystery as that of wheat. It was cultivated at a very early date in India, where it was probably indigenous, and introduced thence into Persia. The plant was cultivated in Italy near Pisa as early as 1468. The introduction into America seems to have been by accident. In 1694 a vessel from Madagascar bound for Liverpool was driven out of its course and put in at Charleston for repairs. A small quantity of rice obtained from the captain was used for seed purposes. Cultivation was so successful that within a few decades the production of rice became the chief industry of the colony. In the early years the cleaning and polishing was done by hand; but in time mills operated by horse, or ox power, or by the tides were introduced. In 1754 upwards of 100,000 barrels of rice were exported from South Carolina.

There are possibly as many varieties of rice as of wheat, but the range of cultivation is much more limited with the former grain. As a rule cultivation is limited by conditions of temperature and of water supply, although some varieties of rice do not require irrigation.

REGIONS OF RICE CULTIVATION

Rice is essentially a crop of the tropics and subtropics. China is probably the largest producer, but it is impossible to know with any degree of certainty even the approximate output of the country. Unofficial estimates for 1917 were 70,000,000,000 pounds, and for 1923, 50,000,000,000 pounds. India ranks next, followed in order by Japan, Java and Madura, Indo-China, and Siam. Considerable quantities are produced also in the Philippine Islands, Korea, Brazil, and Madagascar. Production in the United States has continued to increase since its first introduction. The output in 1926 was over a billion pounds. Cultivation is no longer confined to Carolina. As a matter of fact, this is now the least important of our four producing districts. The Texas-Louisiana

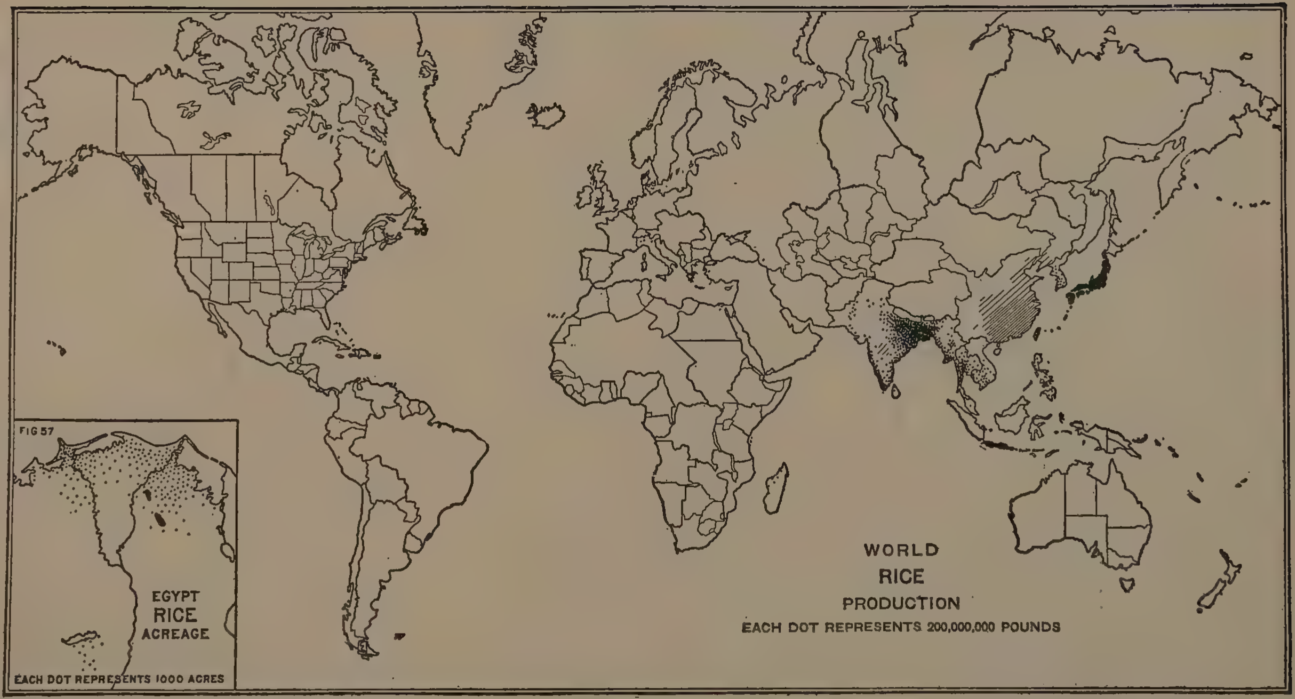


FIG 57
EGYPT
RICE
ACREAGE
EACH DOT REPRESENTS 1000 ACRES
WORLD
RICE
PRODUCTION
EACH DOT REPRESENTS 200,000,000 POUNDS

From Finch and Baker, Geography of the World's Agriculture

Production of rice in the world

region produces more than half the rice grown in the United States; the Arkansas district is the second most important; and the California area ranks third.

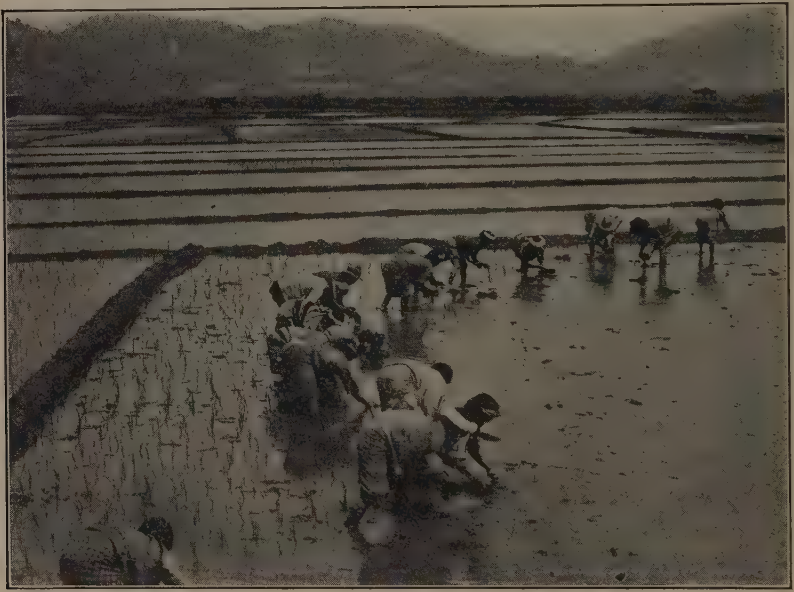
Rice is the great cereal of the Far East, and wheat is the leading crop in Europe and the Americas. In fact, in 1926, the output of rice in the Orient amounted to from 80 to 85 per cent of the world total, while the western world produced about 75 per cent of the wheat. Only in the United States and Brazil was rice an important crop, and these countries produced only a relatively small percentage of the total. In Europe, Italy and Spain together produced about 300,000,000 pounds. The estimated world output of rice in 1926 is presented in the table below.

World Production of Rice, 1926

Country	*Pounds*
China	70,000,000,000
India	66,000,000,000
Japan	17,000,000,000
Indo-China	8,000,000,000
Java and Madura	8,000,000,000
Siam	7,000,000,000
Chosen (Korea)	5,000,000,000
Philippine Islands	2,500,000,000
Taiwan (Formosa)	2,000,000,000
Madagascar	1,500,000,000
United States	1,100,000,000
Brazil	1,000,000,000
Total	189,100,000,000

WORLD TRADE IN RICE

Less than 10 per cent of the rice grown in the world enters international trade while the world commerce in wheat is from 20 to 25 per cent of the total production. In 1925 about 14,000,000,000 pounds of rice were exported from the various countries. India was the largest exporter, sending out about 5,500,000,000 pounds, Siam ranked second with an export of about 3,000,000,000 pounds, and French Indo-China was third with an export of about 2,400,000,000 pounds. This signifies that a much larger percentage of rice is consumed in the country of production than is the case with wheat. In the Far East, China, Japan, and British Malaya are large importers, each taking between one and two billion pounds a year, and in Europe, Germany, France, the United Kingdom, and the Netherlands are large importers. The supply for these countries is brought in from a number of places in the Far East, and rice from both the United States and Brazil is consumed in Europe.



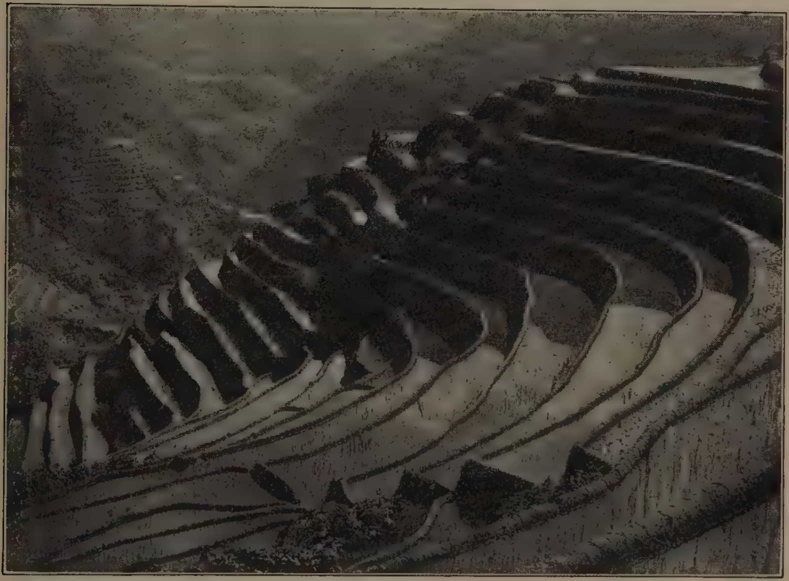
Keystone View Company

Rice planting in the Philippines

USES OF RICE

As with wheat, rice is consumed chiefly as a food for human beings, and in many populous parts of the world the supply must be carefully conserved for this purpose. Since rice, as compared with other cereals, is deficient in protein and fat, it is necessary to balance the diet; in countries which are large rice consumers this is done by the consumption of other products. In China and Japan beans and other legumes serve this purpose.

The rice straw is used to some extent as a fodder for stock, and in China and Japan it is consumed on a large scale for a great many purposes, including thatching and bedding, and for the production of mats, ropes, bags, and sandals. The hulls are often used as packing material and as fuel in factories. Rice flour and meal, which are rich in carbohydrates, are used as stock feeds. Starch is sometimes manufactured from the grain.



Philippine Press Bureau

Mountain rice terraces in the Philippines

In some of the Far Eastern countries rice is one of the raw materials for the manufacture of liquor, as with sake in Japan, and tapuy in the Philippine Islands. Although paper is sometimes manufactured from rice straw, the so-called rice paper is not obtained from this raw material, but from the pith of a small tree (*Aralia papyrifera*). The skill of the artisan has made possible the production of a number of products from this material. The white pith is cut into uniform sheets; it is sometimes dyed in various colors and is used for the production of artificial flowers. Native artists use the white sheets for water-color drawings. The tree from which the pith is obtained grows in the swampy regions of Formosa.

Rice is prepared for the market by cleaning and polishing, the latter process being demanded by the requirements of the trade, and not by the needs of manufacture. In fact, polishing removes a portion of the protein, which is an element in the food value of the cereal.

MAIZE

Indian corn is one of the most important contributions of the New World to the present needs of consumption. In this connection Professor Shaler made the following observation: namely, that while the Americas and Australia have about as many species of vertebrates as the Old World, they have contributed but one animal to the domestic uses of civilized man—the wild turkey;

> while the Old World has given more than a score to such service. On the other hand, the contribution of plants to domestication from the Americas has been most important. Indeed, we may say that the plants which the New World has afforded have been sufficient to make something like a revolution in the economic conditions of our civilization. The potato and Indian corn have profoundly altered the agriculture of Europe. Tobacco has changed the habits of men throughout a large part of the world. The species of cinchona whence comes quinine have been of invaluable advantage to human life; and a score of other American species, such as the tomato, have come to play a more or less important part in the field or garden.[5]

Some authorities would question the statement that America was the original home of Indian corn, but there is no doubt that the product which is now used in many parts of the world was distributed from America, beginning to some extent shortly after the first colonization. For many years, the colonists to the New World did not appreciate the food value of corn, and in many instances, as in life on the frontier, consumption was forced upon them by the needs of the situation. For several hundred years this grain played a most important part in the economy of the people who opened the North American continent to settlement, and while it now plays a different rôle, it is no less important today than it was a hundred, or two hundred, years ago. As a feed for livestock it makes possible the maintenance of an enormous number of cattle and swine, and the production of large quantities of milk, butter, and cheese, to say nothing of many kinds of meat products. Even now, it is an important part of the diet of the poorer populations in many parts of the world.

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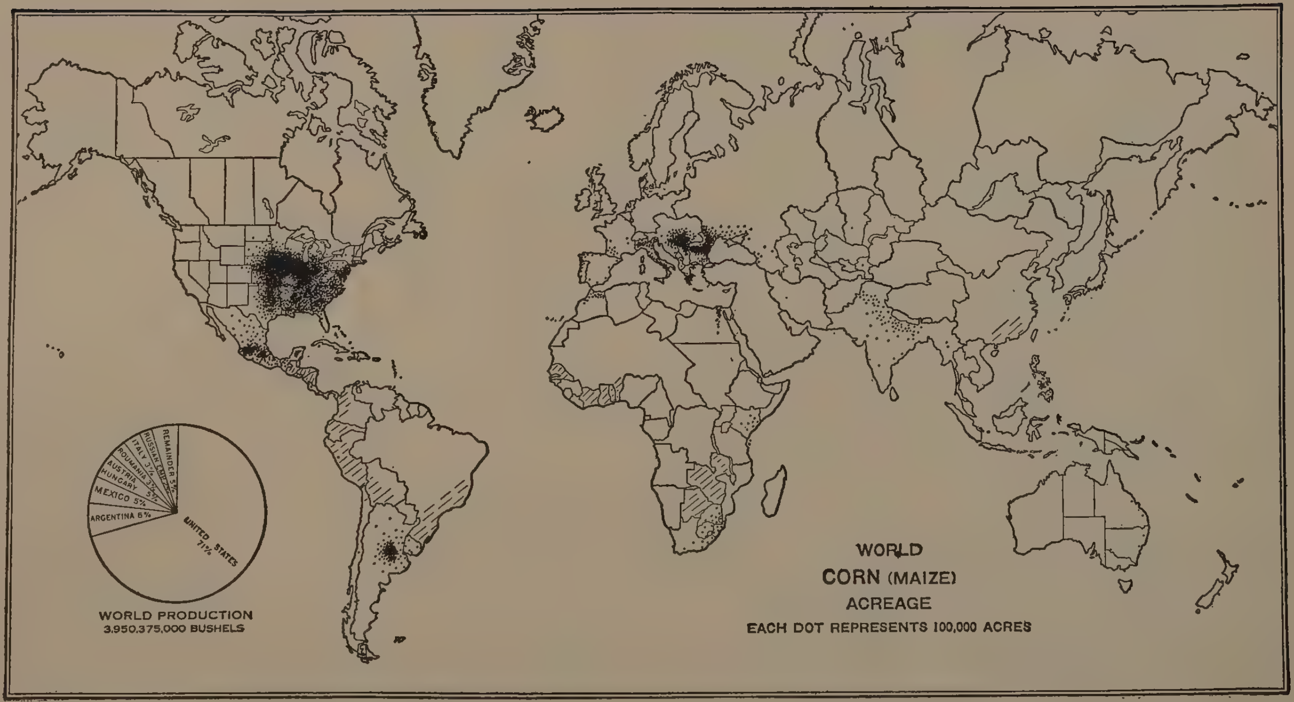
[5] Shaler, *Nature and Man in America,* p. 176.

Corn has many points in its favor as an element in the economy of a people who are living in the agricultural stage, particularly when they are none too well supplied with capital and labor, and when they must economize in the use of these factors. It was for these reasons that corn was invaluable as a pioneer crop. At a time when labor was scarce, and when other crops were uncertain, it was of great advantage to these early settlers to possess a plant which yielded abundantly even under slight tillage, and which produced a wholesome food for both men and beasts. Its hardiness and long harvest added to its value as a pioneer crop. All parts of the plant are usable even in the case of people living in a rather primitive economy, and modern industry has developed uses for corn which were never dreamed of by farmers fifty years ago.

In view of the many difficulties encountered by the pioneers, it is difficult to understand how they could have made rapid progress in the settlement of the country without the aid of a crop which grew readily under the rough conditions of the frontier, and which yielded its product quickly and in great abundance. Notwithstanding the large harvests, only small quantities entered commerce directly, but it was converted into such marketable forms as livestock and whiskey; before the days of adequate transportation, cattle and hogs were driven long distances to market, and whiskey was usually a readily transportable form of merchandise.

KINDS OF CORN

As with wheat and rice, there are many distinct varieties of corn. Some mature within about two months, others require six or seven months. Some have large kernels, others small. The


WORLD
CORN (MAIZE)
ACREAGE
EACH DOT REPRESENTS 100,000 ACRES
REMAINDER 5%
RUSSIAN EMP. 2%
ITALY 3%
ROUMANIA 3%
AUSTRIA HUNGARY 5%
MEXICO 5%
ARGENTINA 6%
UNITED STATES 71%
WORLD PRODUCTION
3,950,375,000 BUSHELS

From Finch and Baker, Geography of the World's Agriculture

World cultivation of corn

grain of these many varieties differ in color, white, yellow, red, and purple being some of the distinguishing marks. Naturally, the physical and chemical qualities vary with the kind of corn. Some of the more common varieties are flint corn, which is cultivated in Canada, in the northern part of the United States, and in general, in the colder portions of temperate climates; dent corn comprising the varieties which are usually grown in the United States; sweet corn which is usually a garden product, served on the cob, or used as a raw material by the canners; and pop corn a familiar article of trade. The original variety grown in America at the time of Columbus was soft corn. The grain was small and round, and was easily pounded in a mortar.

CHIEF CORN PRODUCERS OF THE WORLD

In 1925 about 65 per cent of the total crop of the world was produced in the United States. The output of this country was more than four times that of Europe. The distribution of the world output is shown in the following table.

World Production of Corn, 1925

Country	*Bushels*
United States	2,917,000,000
Argentine	280,000,000
Russia, including Asiatic Russia	176,000,000
Roumania	164,000,000
Jugoslavia	149,000,000
Italy	110,000,000
Mexico	90,000,000
Hungary	88,000,000
Egypt	77,000,000
India	68,000,000
All others	377,000,000
Total	4,496,000,000

YIELD OF CORN

In addition to its other advantages, corn has a relatively high yield per acre. As with other cereals, this varies from season to season, depending on weather conditions. But, as a rule, in the United States, the return is nearly double that of wheat. The average yield of the latter grain during the period from 1909 to 1913 was 14.7, while with corn in the same years it was 26 bushels. Egypt obtains the highest yield with something over 37 bushels. During the period named above it was 27.7 bushels in Hungary, 25.1 in Italy, 23.4 in Jugoslavia, and it was as low as 14.6 in the Union of South Africa and 14.0 in India.

USES OF CORN

Corn ranks far below wheat flour in bread-making qualities, but it is consumed as a food product in one way or another in the United States, Italy, Roumania, and in the Union of South Africa, and its use for food purposes seems to be growing in other portions of the world. Corn bread, brown bread, corn-meal mush, and various articles prepared in more or less deceptive ways by the bakers are commodities of customary consumption in the United States. The Mexican *tortilla* is produced from a thick corn-meal paste, pressed by hand, and baked in an oven or on a hot stone slab. In Italy, *polénta,* a common article of diet, is prepared from corn meal, and the *mamaliga* of Roumania is produced from the same material.

The chief use of corn, however, is in the feeding and fattening of livestock. The great consumption of meat products in the United States, together with the large export trade in these commodities, has been a constant encouragement to the development of stock raising and to the expansion of the meat-packing industry. This business, and the related by-product manufactures, are now largely localized in, or near, the corn belt. Another factor in the great importance of corn in the United States is that it has been used more largely in the feeding of animals than in any other country in the world. The livestock industry of Argentine, for example, was largely built up on alfalfa, although corn feeding is now growing in importance. In some European countries certain by-products, as those of the sugar beet and potato, are important animal feeds.

Corn is the source of more products than is the case with any other cereal. Hominy, canned corn, and various breakfast foods are articles of general consumption. Corncob meal, fodder, silage, corn bran, and oil cake are customary animal feedstuffs. But other valuable products are derived from corn.

Glucose is a white, sweet substance of about half the sweetness of cane sugar, and is used to mix with table syrups, jams, and jellies. It is also used by manufacturers in making candy and chewing gum. Dextrine is a soluble, gummy substance made from the cornstarch, and is used by fine fabric workers, confectioners and apothecaries. One of the most valuable by-products, however, is cornstarch, from which glucose and dextrine are made. It is used to a great extent in cooking, and every mother in the home knows the value of cornstarch in preparing many dishes for the table, and in laundrying the linen for the family. Textile manufacturers use it for the dressing and finishing of many textiles, and especially as a thickening material in calico printing. It is used by other manufacturers in making baking powder, face powder, candies, and even paper.[6]

Corn is also the source of various oils used for lubricating and cooking purposes. Some of these oils enter the manufacture of shaving and laundry soaps, and into the production of paints and the dressing of leather. The cob is sometimes used as fuel, and smokers are familiar with it in the form of corncob pipes. The husks and stalks also serve as raw materials for certain manufactures. Mattress and hat manufacturers use the products. This by no means exhausts the lists of corn products, but it serves to indicate the great variety of articles which may be made from grain and plant.

CORN IN THE EXPORT TRADE

Only a small percentage of the world output of corn enters foreign trade. With its enormous production, the United States exported only 23,000,000 bushels of grain in 1926, and only 516,000 barrels of meal. In fact, when foreign prices are materially lower than those of the United States, corn is sometimes imported into this country. This was the case in 1926 when a little more than a million bushels were brought in. Argentine is usually the largest exporter; in 1925 this country shipped 193,000,000 bushels, which was nearly 70 per cent of the production. Small quantities are also exported from Roumania and Jugoslavia.

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[6] E. C. Brooks, *The Story of Corn,* p. 291.

WORLD PRODUCTION OF OATS

Although the world production of oats is as large, and sometimes larger, than that of wheat, the industry is not as widely distributed over the world. In fact, a few regions in the United States, Canada, Russia, Germany, and Poland produced more than 70 per cent of the total world output. Although the crop is grown to some extent in practically every state in this country, about half our annual production is in Iowa, Minnesota, Illinois, and Wisconsin. The plant thrives best in cooler and wetter climates and is therefore grown most successfully in the higher latitudes. Very little qualification is required to the statement that oats are essentially a North American and European crop. Except for Argentine, with an output of about 66,000,000 bushels in 1927, there was little or no production in the southern hemisphere, and scarcely any in the Far East. In 1927 the United States produced about 1,100,000,000 bushels, Russia about 987,000,000 bushels, Canada 480,000,000 bushels. Germany 434,000,000 bushels, and France 372,000,000 bushels. The crop was also of some importance in the United Kingdom, Poland, and Czechoslovakia.

The origin of oats is about as little known as is that of wheat, but the latter probably has a more ancient history. At least it has attracted the attention of farmers over a much longer period, and through the centuries it has served a much more important purpose than oats. Due largely to the climatic requirements of the plant, the production of oats was of little significance while the population of Europe was centered largely around the shores of the Mediterranean. Production has increased most rapidly during the last sixty years. The output of the United States, for example, has increased about fivefold since 1860. Oats are consumed to some extent in a number of parts of the world as a food, but their chief use is as a feed for horses.

RYE

This cereal is less exacting in its demands on natural conditions than most of the other grains. It will thrive in soils which are too poor for wheat, and it requires less heat during the maturing process. At present, Russia produces more than half the world crop, with an output in 1926 estimated at about 900,000,000 bushels. This cereal is also important in Germany and Poland, production in the former amounting to 286,000,000 bushels in 1926, and in the latter to 234,000,000 bushels. But, as a matter of fact, the cereal is produced to some extent in practically every European country, and very little is produced outside this region, except in the United States, Canada, and Argentine, and the crop of these countries is small compared with some of the more important countries of Europe. Only 58,000,000 bushels were produced in this country in 1927. It may be said, therefore, that rye is peculiarly a European cereal. Production in the United States is confined chiefly to North Dakota, which in 1927 produced about 40 per cent of the total American crop, and to Minnesota, Nebraska, Wisconsin, and South Dakota.

As with oats and corn, rye is consumed chiefly where it is grown. With its huge production, Russia exported only about 6,000,000 bushels in 1926. Rye is consumed largely as a breadstuff in Russia, Scandinavia, and in parts of Germany, and it serves this purpose to a limited extent in many countries. In the United States, the chief uses have been for the manufacture of malt and spiritous liquors and in the feeding of livestock. Russian vodka and Holland gin are made largely from rye. In a few regions, as in Denmark, rye bran and ground rye are fed to cattle, although it is claimed that an excess of feeding of this kind injures the quality of the butter. Rye straw finds rather diversified uses as packing for pottery, horse collars, mattresses, and in the production of paper, hats, mats, toys, etc. A special kind of straw is used for drinking purposes.

BARLEY

Barley is the most adaptable of all cereals; it can be grown farther north than any other grain, and cultivation is successful in subtropical climates. Under these conditions production is distributed widely over the world. The consumption of this grain by human beings may antedate even that of wheat. At any rate, several varieties have been found in the lake dwellings of Switzerland in remains which date back to the Stone Age. It was the chief cereal of the ancient Mediterranean peoples, and in one form or another, it has continued to serve as a food product to the present time. Possibly its present use would be more extensive if it contained enough gluten for bread-making purposes; but it is notably deficient in this respect. At times it has been used extensively in the form of barley cakes, and for porridges, and as an emollient drink for inflammatory disorders. Modern industry makes large use of the cereal in the brewing of beer.

In 1927 the annual crop of the world amounted to a little more than a billion bushels. This crop was more evenly distributed among the producing countries than was the case with any other cereal. Except for the United States, Germany, and India, production did not exceed one hundred million bushels in any country. In 1927 the American crop amounted to 265,000,000 bushels, the German to 122,000,000 and the Indian crop to 120,000,000. Among the Far Eastern countries barley was an important crop in Korea and Japan; in North Africa, Algeria and Morocco produced considerable quantities, and the cereal was grown to some extent in most of the European countries. About 60 per cent of the crop of the United States was produced in Minnesota, North Dakota, South Dakota, and Wisconsin.

OTHER CEREALS

Consumers in various parts of the world have access to several other cereals, but they are of relatively little importance compared with the grains discussed above. Buckwheat is cultivated in Russia, Japan, France, and the United States. Among other uses it is a foodstuff, the most familiar product in the United States being the buckwheat cake. It is used also in the feeding of poultry and livestock. According to an old tradition, the feeding of the cereal to chickens stimulates the production of eggs, but this assumption seems to have little basis in fact. The plant is of great value in the renovating of the soil. For one thing, the growing crop renders the soil more friable, and when used as a green manure it rots quickly and yields certain elements for consumption by succeeding crops. Buckwheat was produced in about 23 states in 1926, the total crop amounting to about 16,000,000 bushels; Pennsylvania, New York, and Minnesota produced more than half the total.

The millets should perhaps be added to the list of minor cereals. There are a number of varieties, including the Great millet or Guinea corn, and bulrush millet. This cereal is a staple food in India, where rice is not readily available, and it is consumed in parts of China and Africa. Millet is also used as a fodder in a number of parts of the world. About a million bushels of millet seed were produced in the United States in 1925. Sorghum is a cereal grass which is cultivated in many varieties, especially in warm countries. The juice of the stalk is one source of sugar. Broom corn, one of the varieties of sorghum, enters into uses suggested by the name.

QUESTIONS

1. Compare the extent of world consumption of wheat with that of rice. Where is rye chiefly consumed?
2. How do you account for the fact that rice is more largely consumed in the Far East than wheat, and that in the western world wheat is more largely consumed than rice?
3. Which is the more important cereal in the western world, wheat or corn? What is your test of importance?
4. Explain the wide diffusion of wheat production over the world.
5. What is the market significance of the fact that wheat may be grown in the northern and southern hemispheres?
6. Account for the differences in yield of cereal crops from country to country.
7. Does a low yield, as the average for the United States, indicate that agriculture is carried on under inefficient conditions? Why?

8. Account for the utility of wheat as a food product.

9. Estimate the importance of wheat as an article of international commerce.

10. Is there any adequate substitute for wheat? Why?

11. State some of the wastes in the consumption of food products. Are these wastes preventable? Do you think that the wastes of consumption in the case of food products are as great as with the mineral products?

12. Estimate the future possibilities of increased wheat production. State in what ways the world's product may be materially increased.

13. Why is the area in which rice may be grown more limited than that for wheat?

14. Name the uses of rice. Estimate the importance of this crop.

15. Explain why corn was a valuable pioneer crop. Is it valuable today for the same reasons as in pioneer times?

16. Why is the United States the chief producer of corn in the world?

17. What are the uses of corn? What industries in the United States depend on corn as a raw material? Where are the industries that consume corn chiefly localized? Why in these places?

18. What are the chief uses of rye, oats, and barley? Where are these crops grown on the largest scale? Why in these regions?

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CHAPTER XV

FRUITS AND VEGETABLES

In the markets of a large city one may find fifty or more different kinds of vegetables, and during the course of the year, fully that many varieties of fruits. Most families, however, use no more than half this number. The varieties which are displayed in the home markets by no means represent the number, or the kinds, which make their appearance in the markets of the world. Most fruits and vegetables for daily home use are of local origin, and naturally they are of the kinds which the community is accustomed to consume. But notable differences exist from country to country, and in distant markets an observer would discover hundreds of products, the names of which he does not know.

STAPLE AND SPECIAL COMMODITIES

Some kinds of fruits and vegetables are cultivated the world round, although the varieties may differ from region to region. This is the case with potatoes, peas, beans, apples, peaches, pears, grapes, to name only a few classes. But, in addition, there are many products which are peculiar to nations and regions. Climatic conditions are always among the chief factors in creating differences—features which perhaps are most obvious in the contrast between tropical- and temperate-zone products. But variations are due in part to local or national tastes, and to habits and traditions. Not infrequently, the economic status of a people largely determines their kind of consumption and, as a result, the products which they cultivate. Regions which have been isolated from the rest of the world, or which to all intents and purposes are now in this condition because of lack of means of communication, have usually developed characteristic products. Sometimes the skill of the farmers, however primitive, has developed new varieties, and sometimes the accidents of selection have been among the causes for the peculiarities of the products of a region. Superstition is sometimes a guiding influence either in the creation, or the perpetuation of regional or national differences. The superstition that potatoes, if consumed regularly, were injurious to the health prevailed for many years and retarded their introduction into a number of parts of the world. It was held that if a man ate them every day he would not live beyond seven years. The Greeks thought that "asparagus was a remedy for intestinal troubles, and that the beet had very fine medicinal qualities. The cucumber was thought to have all sorts of healing qualities, while lettuce, the favorite plant of Adonis, possessed certain narcotic virtues. Garlic aroused the valor of warriors, and it was therefore avoided in times of peace. Parsley excited the brain to agreeable sensations, watercress was very refreshing, and onions were good for preserving the health."[1] And it might be observed in passing that some of these traditions are preserved to the present day. Even now one can find persons who will recommend this or that or the other vegetable because of some real or imagined virtue.

Some of the differences in regional products tend to be equalized in time by transfer of plants from one place to another. The potato, a native of the Peruvian and Chilean Andes, has been cultivated in many parts of the world. Indian corn, another native American product, is now grown in many countries. The soybean, a typical Chinese product, has been introduced into the United States, and our Department of Agriculture has recently recommended the propagation in this country of certain roots, tubers, and bulbs which have been used heretofore almost exclusively in China. Emigrants who engage in farming frequently take with them plants with which they are familiar at home, and thus bring to the home of their adoption not only new products, but knowledge of their cultivation. These are only a few examples. But notwithstanding these various processes of diffusion, notable differences still exist in the products of various regions in the world.

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[1] E. C. Brooks, *The Story of Corn,* p. 93.

LATIN AMERICA

Many North American garden fruits and vegetables are cultivated in all the countries to the south of us, but some Latin American countries may lay claim to characteristic products. Our neighbor, Mexico, produces at least two typical varieties of beans which are of great importance to the country. The frijol, or Mexican bean, and the *tortilla,* mentioned in a former chapter, are staple foods for the masses in this country. The frijol is grown in practically every state of the republic, but production is more largely concentrated in Jalisco and Vera Cruz. Small quantities are exported to Cuba. The *garbanzo* also belongs to the bean family. It is a white, round product, somewhat larger than the frijol. While the crop is produced in many states it does not succeed in the low-lying tropical areas. Unlike the frijol, the garbanzo enters largely into export trade. Cuba and Spain are among the largest consumers.

For many years Mexico practically supplied the world with vanilla. This plant, a genus of the climbing tropical orchid, is the source of an important flavoring extract. The pod, from six to nine inches long, is filled with an oily pulp which contains the seed. This is the vanilla bean of commerce. In preparation for the market the bean is dried slowly and allowed to undergo slight fermentation which develops the characteristic aroma. The Spanish invaders discovered the Indians using vanilla in connection with cocoa, another product of the country. Cultivation has now spread to other parts of the world. Java produces a good quality of vanilla, and this applies to some extent to the ouput of Réunion Island and Mauritius, and inferior qualities are produced in Brazil and Venezuela. Mexico produces bananas and pineapples for export, but the large portion of the North American supply comes from other sources.

The tropical and subtropical portions of Latin America produce many varieties of fruits, which are important for local consumption, but which are not exported except in small quantities as preserved fruits. Even the names of many of these products are not known outside the region of production. Included in the list are the *anón,* or custard apple, a number of varieties of sapote, the tamarind, mamey, alligator pear, mango, and guava. Some countries produce large quantities of plantain, a species of the ordinary banana. Cuba, for example, produces annually several hundred thousand pounds of this product, and exports somewhat less than half her annual production. In Colombia, the plantain is the chief article of food for the masses in the lower districts. The crop is practically a free gift of Nature; it requires little or no cultivation, the yield is heavy, and the plant bears for years. In British Guiana "the unripe fruit is usually eaten boiled, but is better fried, or roasted and buttered. Sliced, dried and ground, it is thought by some to be superior to arrowroot or sago."[2]

A number of varieties of citrous fruits are grown in places where climate will permit. Oranges, grapefruit, and tangerines at times enter into the export trade of some of the countries. The bitter orange grows wild in Paraguay. The leaves are the raw material from which is extracted the oil of petit-grain, which is used as a base for perfumes. Paraguay sometimes exports from one to two hundred thousand pounds a year of this product.

Many Latin American countries produce grapes, and in Argentine they are grown on a large scale for wine making. Mendoza is the center of the industry. Some 300,000 acres are devoted to this product. The output is light wine which is largely consumed in Argentine. Grape production in 1925 amounted to about 115,000 metric tons. A small portion of this crop was consumed locally, and the balance was used in the production of raisins and wine.

A great variety of vegetables are consumed throughout Latin America, including the ordinary garden products known in North America, but including other kinds which are not cultivated in this country. Some are of spontaneous growth, others are cultivated, usually for local consumption. There are a number of kinds of potatoes, including the yellow variety, which is different from our sweet potato, also yams, arum, manioc, certain kinds of yucca, etc. In some portions of South America manioc or cassava is the chief food of natives and of laboring classes. It is a cultivated plant in portions of Brazil, Peru, and Bolivia.

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[2] A. S. Peck, *Industrial and Commercial South America*, p. 43.

Mandioca is the source of the tapioca of commerce. This plant was cultivated by the Indians of Brazil before the coming of the Portuguese. According to their legends it was a gift of the gods during a period of famine. The development of the knowledge of the cultivation of the plant was probably a rather simple matter, but it is remarkable that the natives learned to extract the deadly prussic acid which is contained in the plant. Enock refers to the product in the following words:

> The mandioca, which corresponds to the cassava of other countries, grows wild throughout Brazil; generally it is a shrub some 4 feet in height, which, when cultivated, develops on its roots tubers of various shapes and sizes. The farinha is made for home consumption by the ancient process of washing, pulverizing, and squeezing the root to express the juice, and then by grinding and roasting. The best quality of farinha has the consistency of coarse, whitish sawdust after the process, and is agreeable and nutritious, but the inferior kind, which is that forming the food of the poorer classes, is in the form of brownish lumps, much less inviting and wholesome.[3]

Because of its great yield mandioca is a labor-saving crop. It is estimated that its food value per acre in Brazil is equivalent to that of six acres of corn.

THE BANANA CROP

From the point of view of the export trade, bananas are the most important fruit of Latin America. They are, moreover, a relatively new acquisition to the commerce of the world, at least on a considerable scale. Consumption, however, dates back to prehistoric times. The botanical name, *Musa sapientum,* conveys some idea of the ancient traditions connected with the plant. It was believed that the ancient sages of India reposed beneath the shade of the trees and ate the fruit. India may have been the original home of the plant, but in the course of years it was distributed in many lands. It is now a staple product in practically all tropical and subtropical climates.

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[3] R. Enock, *Republics of Central and South America,* p. 93.

Although existing in some sixty or more species, only four are of industrial importance. First, the *Musa sapientum,* which includes the majority of the bananas supplied to the markets of the western hemisphere; second, the *Musa cavendishii,* a Chinese or dwarf variety grown in South China, in the Canary Islands, and in some of the islands in the Indian and Pacific oceans; third, the *Musa acuminata,* grown in the East Indies and in the Malay Archipelago; and fourth, the *Musa paradisiaca,* taking its name from the legend that the tree flourished in the Garden of Eden; the variety last named is plantain, which is found in practically all the regions where the other kinds grow.

United Fruit Company

Bananas under irrigation in Colombia

These products have been an enormous advantage to the human race as a source of food supply, and even now they serve as the starchy part of the diet for millions of people. But until very recent years the product was consumed where it was grown.

The forerunner of the North American trade was a few bunches brought by schooner from Jamaica to Boston in 1870. In the next few years small shipments were made also to New York, Philadelphia, and Baltimore. A shipment of 250 bunches from Colon to New Orleans in 1872 was more than enough to flood the market. At this time the fruit was looked upon as a curiosity. The history of the banana in the British market is a counterpart of that in America. The first shipment was made from Madeira in 1878, and from the Canary Islands in 1882, but it was some years before this product was established in the British markets.

The North American supply is obtained chiefly from the countries bordering on the Caribbean Sea and the Gulf of Mexico—Guatemala, Costa Rica, northern Panama, Mexico, Colombia, and Jamaica being the chief exporting regions. In most instances the plantations have been developed by foreign enterprise, American capital taking the lead both in management and ownership of plantations, and in transporting and marketing the product. In some Central American countries the banana is sometimes grown as a kind of joint product along with coffee. The former serves to shade the young coffee tree. The use of the two crops in this way has recently enabled Costa Rica to expand her production of bananas and to increase her shipments to the United Kingdom.

The production of bananas has become a highly organized industry. Not only are the plantations carefully laid out and operated under a system of division of labor, but the methods of transportation by land and sea are subjected to the same kind of organization. Trunk and tram lines usually connect the plantation with points of shipment, whence the product is carried to market, usually in refrigerator cars, and unloaded at ports of destination—very often by special equipment, and under the direction of men who are skilled in the business.

Bananas constitute the largest single import of fruit products into the United States. While a considerable variety of foreign fruits are brought into this country, including grapefruit, lemons, oranges, pineapples, dates, figs, and olives, the annual value of the shipments is small compared with the value of the bananas. In fact, this commodity frequently amounts to from 50 to 60 per cent of the total value of imported fruits. The value of such imports is given in the table below.

VALUE OF FRUITS IMPORTED INTO THE UNITED STATES, 1926

Kind	*Value*
Bananas	$31,684,000
Olives	4,351,000
Figs	3,017,000
Dates	2,635,000
Pineapples, including the prepared and preserved	2,500,000
Cherries, prepared and preserved	2,400,000
Lemons	1,700,000
All others	6,176,000
TOTAL	$54,463,000

PINEAPPLES

This plant succeeds in almost any region where there is sufficient heat and moisture. It does not require the great heat of the tropics, but, on the other hand, it is exceedingly sensitive to cold. It is grown in a number of places in the western world, including Mexico, Cuba, Porto Rica; in several of the South American countries; and to some extent in the Bahamas. It is the second most important crop in the Hawaiian Islands, where the industry is more highly organized than in any other place in the world. The pineapple industry is important in the Malay Peninsula, the export, largely as canned product, reaching the outside world through Singapore. The product is also successfully grown in Queensland, Natal, and the Gold Coast. The commercial world is interested in the pineapple only as a fruit, but the natives in the growing countries use the fiber for a number of purposes, such as the production of cloth, rope, and cordage, and in some cases they make an excellent fabric.

FRUITS IN THE MEDITERRANEAN COUNTRIES

In some respects, the countries bordering on the Mediterranean are one of the most important areas in the world for the production of fruits. For one thing, they contribute a number of characteristic products to international commerce. Some of the special contributions of this region are olives and olive oil, grape wines of many descriptions, figs, dates, and certain citrous fruits.

Through the ages the products of the olive tree have added enormously to the welfare of the people in the countries where the tree grows. This is recognized in legendary lore. Athene and Neptune desired possession of Athens and the reward was to go to the one who produced a gift most useful to man. Neptune struck the ground, and a horse appeared; but Athene, with greater wisdom, according to the legend, "planted the olive, and the gods gave her the city, rightly judging that hers was the more valuable gift. An olive branch was regarded as the symbol of peace, and a crown of wild olives was considered the highest reward of bravery."[4]

It is impossible to decide upon the merits of the decision of the gods, but it is true, nevertheless, that the olive has served many valuable purposes. The fruit itself is not only an important article of consumption, but the oil, among the poorer classes in the producing countries, takes the place of butter and other animal fats. It is used for cooking and is spread on bread as we would use butter. Nor is this all. The olive is the source of a number of important by-products. The fruit is subjected to a number of pressings; the first yields a small quantity of the best oil; poorer grades are obtained from the second and third pressings. The residue is used for the manufacture of soaps, or converted into oils for lubricating and illuminating purposes. In many regions the extraction of the oil is still performed by a crude hand press. The olive is esteemed not only for its oil, but for the pickled products which appear in the markets as green and ripe olives.

The products of the olive tree which enter export trade originate chiefly in Spain, France, Italy, and Greece, but the tree is cultivated in a number of parts of the world, including California, and to some extent in Argentine, the tree having been introduced into that country by the Italian emigrant. Production of olives is an established industry in South Australia, and it is claimed for this section of the world that the fruit is destined to be of great importance. The olive trees of Turkey produce abundantly every alternate year, a fact which is recognized by the collector of the tithes "in order to establish an appropriate compensation for the years of scarcity."[5] Prior to the War the acreage in Turkey devoted to olives was about 500,000, or about one-tenth the area used for this purpose in Italy. Many of the fruit-bearing trees in southwestern Anatolia, their principal habitat, were destroyed during the retreat of the Greek army. The production of olive oil in some of the leading Mediterranean countries is shown in the table on page 309.

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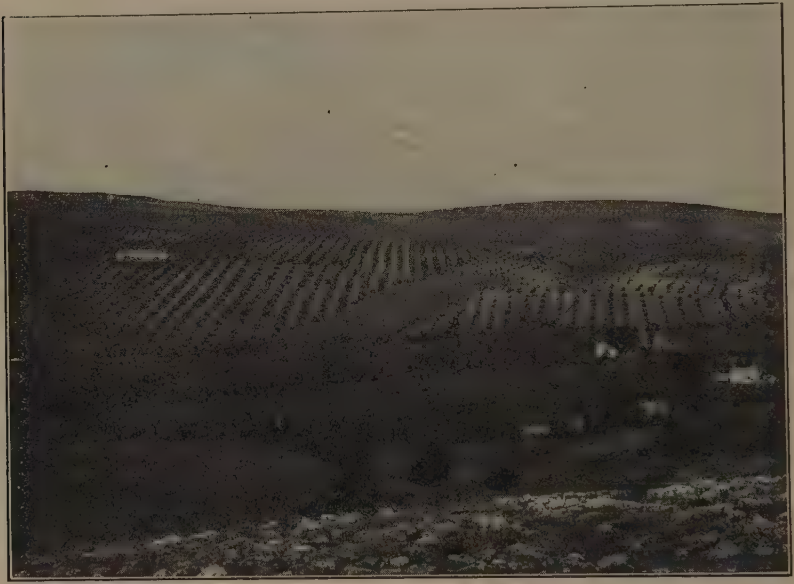
[4] J. C. Cunningham, *Products of the Empire,* p. 137.



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Olive orchards in Spain

Figs are chiefly the product of Asiatic Turkey, although they are grown in several parts of the world, and with a little experimental enterprise cultivation could be considerably extended.

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[5] C. B. Ravndal, *Turkey*, p. 100.

Production of Olive Oil, 1925 and 1926
(*gallons*)

Country	1925	1926
Algiers	7,245,000	3,187,000
Greece	16,626,000	30,119,000
Italy	38,871,000	49,3[illegible]3,000
Spain	94,900,000	67,213,000
Total	157,642,000	150,132,000

The history of production in California bears out this statement. In 1926 California produced about 26,000,000 pounds of figs, which supplied about one-third the needs of our domestic markets. In Turkey, production for commercial purposes is confined to nine or ten districts lying to the south and east of the city of Smyrna. This city handles the entire export trade. In 1913 production amounted to 19,500 tons, and in 1924 to 26,000 tons. The United States and the United Kingdom are the principal markets for the Smyrna fig crop.

Dates are the fruit of a variety of palm which thrives principally in north Africa, not far from the Mediterranean. The commercial supply is obtained from Algiers, Morocco, Egypt, Persia, and Mesopotamia. From fifty to seventy million pounds of this product are imported and consumed annually in the United States.

The Mediterranean area is also a great source of currants, raisins, and grapes which are produced in enormous quantities in all the countries bordering on this sea. Currants are the product of a seedless grape which grows abundantly in Greece and in certain outlying islands, frequently called Corinthian grapes. The production of this country in 1926 amounted to 256,790,000 pounds. Although Greece has been for years the chief source of supply, production is growing in other parts of the world, as in California and in the basin of the Murray River in South Australia.

The Mediterranean fruit industry which has reached the highest degree of development is the growing of grapes and the production of wines. The four principal wine-producing countries manufactured over 3,800,000,000 gallons in 1925. If this seems

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An Egyptian date-palm plantation

to be a shocking figure, there is some consolation in the fact that not more than 15 or 20 per cent of this enormous production was consumed outside the producing countries, and this large use is partly due to poor water supply. Even primitive man learned the art of using alcoholic beverages to protect himself against the attack of certain diseases which he attributed to impure water, and wine is drunk in many countries today, partly for the same reason.

Other countries of southern and central Europe grow grapes and produce wine, but the industry elsewhere is of small importance compared with that of France, Italy, Spain, and Portugal. In 1924, the last-named country exported more than 500 million gallons of wine, of which about 148 million were port. The output of some of the principal producing countries is shown in the following table:

PRODUCTION OF WINE IN CERTAIN COUNTRIES, 1925 AND 1926
(*gallons*)

Country	1925	1926
Algiers	293,592,000	201,508,000
France	1,658,123,000	1,077,499,000
Italy	1,198,464,000	979,440,000
Spain	705,272,000	416,162,000
TOTAL	3,855,451,000	2,674,609,000

The wine-making industry yields a considerable number of important by-products. The pomace, which is the residue of pulp and skins left in the vat after fermentation, is the source of cheaper grades of wines and brandy. In some places, pomace is used as feed for cattle, and the seeds are fed to cattle and poultry as a substitute for cereal feeds. The seeds are also a raw material for the manufacture of oil, which, when refined, may serve the same purpose as olive oil; and from the tartar, which is deposited on the sides of the vat, is produced the cream of tartar which is used in the baking arts.

The Mediterranean countries are also the source of a considerable variety of nuts which are more or less a characteristic of the region. Filberts are exported from Spain and Asiatic Turkey; almonds from Spain, Italy, Turkey, Portugal, and Morocco; Turkey also exports pistachios and pignolias (the edible seeds of the pine cone), these nuts being largely a product of some of the southern Turkish provinces. Almonds are produced in other parts of the world, and climatic conditions elsewhere seem to indicate that cultivation can be more widely diffused than at present. Some 15,000,000 pounds were produced in the United States in 1924, chiefly in California, and there is promise of growing industry in Victoria and Queensland.

The citrous fruits are also characteristic products of the Mediterranean area, although they are produced rather extensively elsewhere. Oranges, lemons, and limes are the most important, although the citron is cultivated to some extent.

Oranges, at least in Europe, are a much more modern fruit than figs, dates, and olives. They were not known in the Mediterranean countries before the fifteenth century. They are supposed to have been introduced by the Portuguese navigators into the Azores and Portugal, whence cultivation spread into Spain, and to some extent into other countries. There are many varieties of oranges, distinguishable by the ordinary observer by the size, shape, and flavor. Possibly they have all originated from two varieties, namely, the sweet, or Chinese orange, and the bitter variety. This fruit was probably indigenous in India and spread thence to the east, and later towards the west. Oranges have been cultivated in China, Japan, and the Indian archipelago for many centuries, but they were first introduced to the western world as one of the results of Spanish and Portuguese explorations. In recent years, scientific selection and cultivation have multiplied the number of varieties, and possibly have obtained a better adjustment of quality to the popular demand.

Burgert Brothers

Citrus groves in Florida

Spain and Italy are the chief producers in Europe, and the principal sources from which Europe is supplied, although the fruit is imported also from the United States, the West Indies, Asiatic Turkey, the Azores, and to some extent from South Africa. In 1926 Spain exported more than 1,500,000,000 pounds, and Italy about 300,000,000 pounds. The industry is relatively new in the United States, having developed with the growth of California and Florida since 1860. But this country now supplies its own needs. Production in 1924 amounted to over 27,000,000 boxes. Sicily is the chief source of supply of lemons for European consumption, and limes are obtained from the West Indies, principally from Dominica. The United States is also a producer of lemons, the crop of 1919 amounting to 6,500,000 boxes. This did not supply the domestic demand; and this applies also to grapefruit of which we produced 3,600,000 boxes in 1919.

PRODUCTS OF THE ORIENT

We have already observed that many of the fruits which are now cultivated in Europe and the Americas were native products of Asia, and many varieties are still important articles of consumption. We might add other more or less specialized products. Jujubes, or Chinese dates, are a product of the drier regions of the north; the natives prepare them for consumption by drying and sweetening, occasionally adding honey. This fruit has been recently introduced into California. The Chinese persimmons exist in many varieties; the red hawthorn of north China is a source of jellies and preserves; the litchi, known in America as the Chinese nut, is a product of the southern provinces. Among the other products are pomelos, Chinese wild pears, apricot kernels, which are similar to the American almond, bamboo sprouts, velvet beans, and ginger. Vegetable gardening is an old art in the country.

The soybean is one of the most valuable products of the country.

> Bean oil is used very extensively in China for cooking purposes. Beans are used to manufacture imitation meat foods for vegetarians. There are restaurants in China which serve fried chicken, fried ham, etc. made of bean composition, but so cleverly done as often to deceive the palate. Bean milk is not uncommon. The Chinese have developed no dairy industry but obtain their needs in butter and fat from bean products.

> Bean oil is also used for making soaps, as an illuminant, to coat waterproof cloth and paper, and for preparing paper for lanterns and umbrellas.[6]

It might be said in passing that both manufacturing and household consumers in the United States have learned to use the soybean. In 1919, about 113,000 acres were planted with this crop. The oil is used in the manufacture of soap, and toilet powders, and for cooking and salad oil.

In India, rice and wheat are important food materials, but they are supplemented by other products which are more or less characteristic of the country as a whole, or of certain regions. The pulses—chiefly gram, mash, and mung—are consumed throughout the country. The plantain is a common food. Large gardens are devoted to it in some places, but it is often grown in small patches around the homestead. In many parts of India it ranks next to the mango as a staple article of food. The coarser kinds are usually cooked before eating. Plantain meal is prepared by slicing the core, drying in the sun, and then pulverizing and sifting. The plantain is said to be a most economical crop not only with respect to its high yield, but to the many uses to which plant and fruit can be put. With regard to its general utility it resembles our Indian corn. An acre will "support a larger number of people than a similar area under any other crop, and the immense yield may be preserved for an indefinite period by drying the fruit and preparing the meal."[7] The flower heads are cooked, as a rule in curries; the inner portion of the stem is prepared for food purposes; shoots and tops of the young plant are consumed as vegetables, and as fodder for sheep and cattle, and the roots are fed to cattle to increase the quantity of milk. And finally, the fiber is manufactured into cordage, mats, and coarse paper.

Curries, compounded in many ways, are consumed by most Indian families. Such compositions contain some cereal or vegetable product with the addition of spices and condiments to suit the tastes of the consumers, as for example, "coriander, tumeric, cummin, pepper, dry ginger, fenugreek, cardamoms, chillies, mace, mustard, cloves and poppy seeds."[8] It is sometimes said that man is omniverous, but the American and European digestion has some trouble in disposing of Indian foods. Nevertheless, in India the curries are said to be good for weak stomach, and for imperfect digestion. The outside world must wonder what the Indian digestion is at its best. But the consumers of this country relish other products which are even less inviting to European consumers. Mango chutney is a fair example. By way of preparation the fruit is boiled in vinegar until tender. It is subsequently mixed with another preparation composed of "pulped dried apricots, almonds, ground green ginger, garlic, red chillies, and ground mustard seeds,"[9] which portion of the composition is prepared by boiling with vinegar and sugar. From our point of view the interesting feature is the use which this people has made of nature's varied product.

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[6] *China,* Trade Promotion Series, No. 38 (U. S. Department of Commerce), p. 229.

[7] H. D. Baker, *British India,* Special Consular Report No. 72, p. 397.

India produces a great variety of oil seeds. Sesame, grown in peninsular India, is used largely in the manufacture of soaps, and large quantities are exported. Linseed is grown principally in Bengal, and in the United and Central Provinces. This plant also supplies a large export trade. North India produces large quantities of cruciferous oil seeds, such as rape, toria, and sarson. These crops are frequently used in some system of rotation, since they grow quickly and leave the soil in good condition after harvest. Ground nuts are staple products in many parts of India, and the country produces many kinds of fruits and melons, the latter including the "garma," a summer melon, and the "sarda," produced in autumn. The juice of the wild lime is used universally for flavoring soups, curries, fish, and other dishes.

STAPLE FRUITS AND VEGETABLES

There are a vast number of these products, which are more or less common to all countries, although the varieties differ from place to place. Market and truck gardening are widely diffused industries, practiced in practically every region where people are congregated. The quality and quantity of the product usually depend on the skill of the gardener. The gardening industry has reached the highest stage of perfection in France, Germany, Holland, England, and the United States. In each case, certain regions are noted for their garden products. The needs of dense populations, concentrated into great communities, have made systematic cultivation necessary, and the condition is further complicated by the existence of highly specialized, and diversified, tastes which require for their satisfaction an extensive system of grading, from the common potato to the various articles which may be regarded more or less as luxuries. To a large extent the gardener makes the conditions under which he works. He creates the kind of soil which is needed for his specialized products, and he often forces the growth of the crop in greenhouses, and otherwise.

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[8] Baker, *op. cit.*, p. 267.

[9] *Ibid.*

Potatoes, and beans of many kinds, are staple foods in practically every part of the world. The cultivation of beets, cabbages, carrots, celery, lettuce, cauliflower, cucumbers, eggplant, kohlrabi, onions, parsnips, peas, turnips, and tomatoes are widely diffused over the earth. The consumption of dandelion greens, okra, leek, collards, gherkins, kale, chards, cress, and endive may be less widely distributed, but they attract a vast number of consumers. Apples, pears, peaches, plums, and cherries are among the most widely distributed of the fruits, varieties and qualities differing from region to region, and from country to country. The inertia of consumption has much to do with fixing of certain qualities in both fruits and vegetables, and a people that does not respond readily to the allurements of variety often adheres to a few products, although greater varieties may be offered. Fad and folly sometimes determine the selection of fruits and vegetables, as is indicated by the quality markets in any great American city, where consumption is often dictated by novelty rather than by consumption qualities, or staple characteristics.

THE TRADE IN FRUITS AND VEGETABLES

Not many years ago the production of fruits and vegetables was a local industry, the commodities being consumed in the localities where they were grown. The only exception was the case of dried fruits and dry vegetables, which were not as perishable as the fresh varieties. The development of rapid transportation during the last seventy years, the introduction, shortly after 1870, of methods of refrigeration, and the growth of the newer industries engaged in the canning and preserving of fruits and vegetables, have made possible a great extension of the market. But even now, the vast majority of the commodities which appear on the table of the average household are the product of farms located but a short distance from the place of consumption.

Under certain conditions there is some exchange of products between rather distant regions within countries, and among countries. Sometimes this is due to the specialization of production in regions which offer unusual advantages for growing, as with melons, grapes, citrous fruits, and out-of-season products grown in some of the warmer regions. In the United States this is true to some extent with potatoes. In 1926, more than 4,300,000 tons of this product were carried on our railroads. In the same year more than 10 per cent of the American potato crop was grown in Maine, and there was a notable concentration of the industry in New York, Michigan, Wisconsin, Colorado, and Idaho. But every state in the Union produced potatoes, which indicates that, notwithstanding the long-distance marketing of a certain portion of the crop, the local farmer administered to the needs of many of the near-by markets.

There is some international trade in fruits and vegetables, although the amount is remarkably small, considering the magnitude of consumption. To take an example from the United States, in 1926 the value of our exports of fruits and vegetables, including canned goods, was less than 3 per cent of our export commerce, and the ratio of imports of such goods to total imports was about the same per cent. Certain specialized commodities, which are produced under favorable circumstances elsewhere in the world, make up the bulk of the international trade in fruits and vegetables. This includes, of course, olives, figs, dates, citrous fruits, bananas, apples, and nuts. Small quantities of American apples are exported to Ceylon and Australia; potatoes and onions from Bermuda are sent to American and European markets; lima beans from Madagascar find their way to both Europe and America; all kinds of early vegetables, grown in Algiers, are carried by fast steamer to Marseilles, whence they are distributed through France. Small amounts of garden crops cross all the national borders of Europe, but as compared with the total commerce, such exports and imports are small.

In 1926 the imports of fruits and vegetables amounted to only 2 per cent of the import commerce of the United Kingdom. Apples were the most important product, amounting to $46,400,000, and oranges were the next most important, valued at $37,100,000. In the case of Germany, the percentage was even smaller. Imports of fresh vegetables amounted to $23,596,000, and of oranges, to $13,600,000. And a similar condition prevailed with regard to France. This indicates that the countries of the world largely supply themselves with products of orchards and gardens, and confine their importations chiefly to such products as cannot be produced to advantage at home. But this is not to say that this type of commodity ranks low in the list of consumable goods. We have already indicated that the vegetable products are in many cases the mainstay of the people in many parts of the world. In the United States, in 1924, the total production of fruits and vegetables was a little more than $2,000,000,000, of which the vegetables amounted to $1,300,000,000, and the canning and preserving industries, based on the products of garden and orchard, produced commodities valued at $688,000,000. A similar explanation would apply to other countries.

THE POTATO

We have reserved the place of honor in this chapter—the final entrée—to the potato, sometimes called the "king of vegetables." That it merits this title is shown by the fact that in the United States, at least, the value of the crop is about 65 per cent of that of all the vegetables. In several of the European countries its relative importance is even greater than in the United States. The known output of the world is more than 5 billion bushels, but actual production is much greater because the potato is grown in many places where no records are kept. Production in the leading countries is shown in the appended table.

PRODUCTION OF POTATOES IN CERTAIN COUNTRIES, 1926

Country	*Bushels*
Russia	1,865,794,000
Germany	1,103,420,000
Poland	914,117,000
France	384,300,000
United States	356,360,000
United Kingdom	176,617,000
TOTAL	4,800,608,000

It is interesting to observe that the preëminent position which North America holds in the production of cereals is not maintained in the growing of potatoes. The combined crop of Canada, the United States, and Mexico is less than 10 per cent of the annual production of Europe.

The potato was cultivated by the aborigines along the west coast of South America for years before the Spanish discoveries. For several hundred years the Europeans paid very little attention to the vegetable. Sir Francis Drake is said to have introduced the potato into England in 1586, but its possibilities as a food product were not regarded seriously until about the middle of the eighteenth century. An occasional failure of the grain crops gradually brought home to the people a need of diversification of crops; and this became more necessary, in subsequent years, with the growth of population, which, in addition to an insurance against the failure of grain crops, made necessary the development of a cheaper food than the cereals. No doubt the cheap potato was itself a factor in the multiplication of numbers, at least in some European countries, and thus there was set up a vicious circle. In recent years the development of potato growing in certain countries of Europe has been stimulated somewhat by the use of this vegetable as a raw material for various manufactures, such as starch, alcohol, potato flour, fodder meal, and other products. In fact, with respect to the number of products which may be obtained from it, the potato is becoming a rival of corn.

Naturally, with the growing importance of this vegetable, experimenters set to work to improve its quality. They set as their "standards of potato excellence . . . good shape, white flesh, strong growth, hardiness, fine flavor and early ripening." This was a big order but, at that, they were not content. The list has been further amplified. The potato "must not be soggy when cooked, nor yet too lumpy. The yield must be heavy, and resistant to disease, and a popular fancy demands of the finest grades that they shall be round or oval and flattish. Also convention has outlawed the red-skinned potato, except in the southern states." [10]

Under more intensive systems of cultivation the European countries succeed in obtaining a higher yield than the United States. In the United Kingdom, for example, it is about 222 bushels per acre, in Germany 183 bushels, in Poland 178 bushels. However, the yield in this country has increased during the last fifty years. During the ten-year period from 1866 to 1875 it was 93 bushels, but in a five-year period from 1921 to 1925 it was 106.9 bushels. This yield, in the United States, varies greatly from state to state as a result partly of growing conditions, and partly of the skill of management. The yield in New Hampshire in 1925 was 250 bushels per acre, and in Maine 214 bushels, but in many states it dropped below 80 bushels.

QUESTIONS

1. What vegetables are produced practically the world over? How do you account for the wide diffusion of these vegetables?

2. Name some fruits and vegetables that are more or less local, or national, in their use. Why has not their consumption become more widely diffused?

3. Why is the production of fruits and vegetables as a class of commodities so widely diffused?

4. Do you think that backward peoples, or countries, choose the fruit and vegetable crops for cultivation which can be produced with the least amount of labor and expense? Why?

5. Give a brief account of the introduction of the banana as an article of commerce. Since it has been grown for many centuries, why did it

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[10] D. C. Peattie, *Cargoes and Harvests*, p. 167.

become an article of international commerce only within the last sixty or seventy years?

6. Estimate the economic importance of the banana and the potato to the peoples of the earth. Why are these commodities important?
7. Discuss the important fruit products of the Mediterranean area.
8. Estimate the economic importance of olives to the countries in which they are produced.
9. Estimate the importance of wine making in the Mediterranean countries. Why has this industry reached such extensive development in these areas?
10. State the rôle of the soybean in Chinese consumption.
11. Discuss the export trade in fruits and vegetables giving the chief characteristics.
12. Account for the very general use of the potato as a food product.

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CHAPTER XVI

LIVESTOCK

Men and domestic animals inhabit about the same areas—a condition which is rendered necessary by the many services which animals render to man. They have been used from time immemorial as beasts of burden, as draft animals for farm purposes, for food products, and as sources of clothing, whether in the form of wool or leather. In recent years, meat products of various kinds have become important articles of international commerce, and the chemist has discovered that hundreds of useful products can be manufactured from the refuse of the packing houses. The modern animal industry now supplies not only meats, butter, milk, and cheese, but hides, tallow, grease, fertilizers, products of horn and bone, raw materials for the manufacture of soap and glycerine, and many pharmaceutical products. All in all, the animal industry has become one of the most important branches of economic activity in some of the countries of the western world.

CONSUMERS AND NONCONSUMERS OF MEAT PRODUCTS

Naturally, all our ideas are colored by occidental points of view, and this applies as well to our concept about consumption. At first thought we might be inclined to say that the use of meat is universal, but this is far from the truth. A very considerable proportion of the population of the world does not consume meat, and other portions of the world population are most selective in this consumption. Many factors decide the course of use. The economic element—the ability to buy—often plays an important part. At least in densely populated areas, particularly where the people are living close to the margin of subsistence, the use of meat products must be rigidly restricted because the people cannot afford to make extensive use of land in rearing animals. And, if they are poor, as is often the case with people living in densely crowded regions, they cannot afford to import. But habits of consumption, and tradition, and what is of greater importance, the injunctions of religion, frequently impose rigid restrictions on the eating of animal products.

In various parts of the world vegetable oils have begun to compete with animal fats both in manufacturing uses and in household consumption. Copra oil is used extensively in Europe in the manufacture of butter, and margarine, manufactured in the United States, contains large quantities of coconut, cottonseed, and peanut oils. The margarine output of the United States in 1925 amounted to 215 million pounds. Substitutes of this kind will increase unless the price of meat products can be reduced. In Italy, olive oil is a rival of animal fats both for cooking purposes, and among the poorer classes as a substitute for butter. Rural families in this country often keep their own pigs and manufacture the products, but per capita consumption is relatively small. Possibly, the habits of consumption have something to do with these conditions. For centuries the staple articles of Italy have been fruits, vegetables and vegetable oil, and bread and macaroni; and these consumption habits have been largely reënforced by economic conditions, for many of the people cannot afford anything but a very meager meat diet.

Religious prohibitions are a large factor in determining the use of meat in India. The religion of most of the Hindu sects prohibits the use of meat of any description, and the Mohammedans are forbidden to eat pork. Under these conditions the meat requirements of the vast population of India is reduced to the minimum. In a way, these restrictions are fortunate, partly because the people have been forced to find cheaper, and possibly more wholesome, substitutes, and partly for the peace of mind of the people who are relieved of the struggle for what might be considered a necessity of life. In fact, the country could not support a per capita consumption equal to that of some of the European countries. A similar economy takes place in the use of butter. The ranking milk product of India is ghee, obtained from the milk of the buffalo. This product is sterilized in order to prevent it from becoming rancid in the hot climate of India. But as a measure of economy it is also largely adulterated with fats and oils. Ghee has entrenched itself to such an extent in Indian consumption that it would be impossible to replace it with butter. A publication of our Department of Commerce gives the following reasons for this conclusion: "(1) The inherent keeping capacity of ghee due to the prolonged high temperature employed in its manufacture; (2) the ready adjustment of the market price of ghee to the requirements for various grades, by adulteration with sesame oil, coconut oil, and animal fats; (3) the prejudice against butter as an article manufactured under conditions that may have brought it under the ban of religion or caste: "[1]

A different condition prevails in China. The Chinese have never developed the dairy industry, and neither butter nor cheese is in general use. Concoctions manufactured from beans largely take the place of milk. Except in Mongolia, cattle are used only as farm animals, and the number is remarkably small, even for work purposes, considering the vast amount of farm labor required to produce the annual crops. There are probably not more than 30,000,000 cattle in all China. Here, as in other parts of the world where the consumption of meat products is small, the condition is probably due largely to economic factors, for at least in the densely populated areas the people could not support a cattle industry for food purposes. As a rule, farms are very small and the land must be worked intensively to support the farmer and his family.

The condition is somewhat different with hogs and poultry. The latter largely forage for themselves. In fact, "Custom often decrees that any one family or household can raise no more than a specified number, as the fowls are allowed to roam about the village to find their food."[2] But, at that, the country produces a prodigious number of eggs. Upwards of 3,000,000,000 eggs a year are required to produce the albumen and yolk which enters the export trade. Hogs, also, are a part of the economy of household or community, since they subsist in part, at least, on the waste. The country contains large numbers of these creatures —from 60 to 100 million, according to some estimates.

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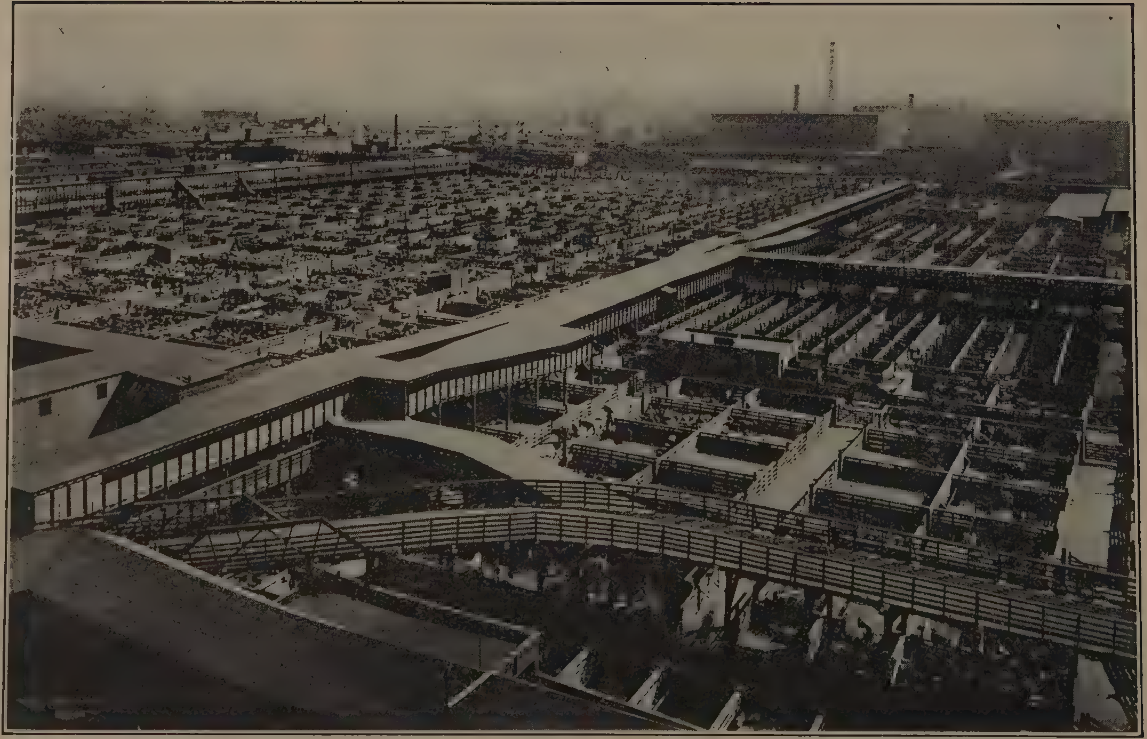
[1] *British India,* Special Consular Report No. 72, p. 370.
[2] *China,* Trade Promotion Series No. 38, p. 274.

DOMESTIC PRODUCTION OF LIVESTOCK

Only three or four places in the world produce large quantities of meat for export. These are the United States, Argentine, New Zealand, and Australia. Canada, Uruguay, Brazil, Venezuela, and the Union of South Africa export certain amounts. But other countries produce considerable amounts for home consumption, sometimes with a rather large surplus for export. The first group of countries named above is the chief source of surplus production.

The United States now produces enough of all meat products for domestic consumption, and in the case of pork and lard there is a large surplus for export. Home consumption is gradually absorbing the surplus of beef, and the export of this product has been declining. The average annual export for the five years ending with 1914 was 62,000,000 pounds, while in 1926 it was only 22,000,000 pounds. Whether or not we have reached our capacity for production is open to question. But there is no doubt that general farming has been encroaching upon the ranching areas for a number of years. For the most part, the open range passed out of existence about thirty years ago and since that time the rancher has not been able to rely on the free bounty of nature, but has been compelled to buy feedstuffs on a basis of gradually rising prices. The number of all cattle on the farms has remained relatively stationary since 1900, notwithstanding the increase in population. These conditions do not portend either an increase of production, or any additions to our export trade. In fact, the time is at hand when the United States, like some of the larger countries in Europe, will become more and more an importer of beef.

But we are not anywhere near this margin in the case of pork and its products. As a matter of fact, the export of the several kinds of pork, exclusive of lard, amounted to 396,000,000 pounds in 1926, and allowing for annual variations, this is not much below the shipments of the five years ending with 1914. More-



Armour and Company

The Chicago Union Stock Yards

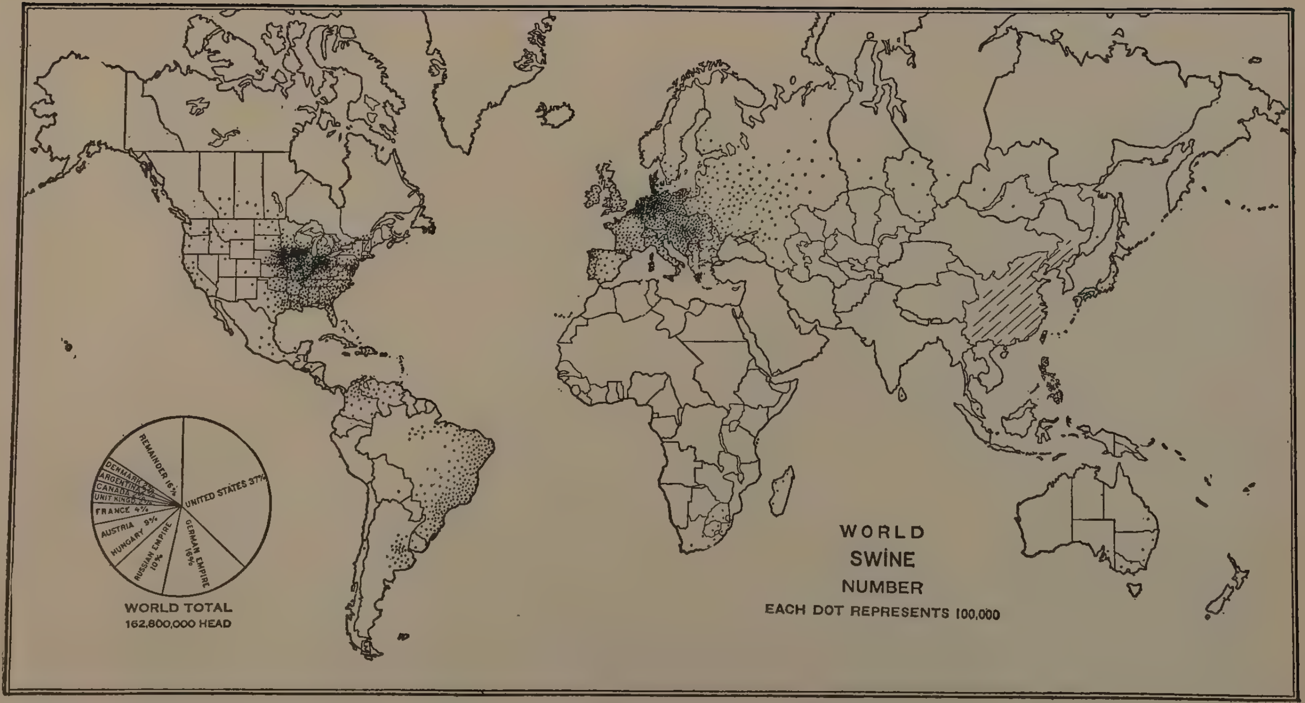
over, this country has by no means reached its capacity for the production of hogs. The conditions under which these animals are raised are quite different from those necessary for cattle; production is diffused among several million farmers, many of whom have not yet learned the proper conditions for raising and protecting the stock. In 1926 this country exported 698,000,000 pounds of lard. In the case of pork and its products, the United States is the largest exporter. In fact, our shipments in 1926 amounted to more than half the world total. The chief importers are the United Kingdom and Germany, which together take about 60 per cent of the total. The shipments of the chief exporting nations are shown in the table below.

World Trade in Pork and Pork Products, 1925

Country	*Pounds*
United States	1,241,209,000
Denmark	462,925,000
Netherlands	259,464,000
Canada	156,717,000
Irish Free State	78,280,000
Poland	57,735,000
All others	140,561,000
Total	2,396,891,000

Notwithstanding the large exports of pork products, the United States produces primarily for the domestic market. In 1926 only about 10 per cent of such products were exported, and in the case of beef it was less than one per cent. In spite of the large concentration of the packing industry in Chicago, St. Louis, Kansas City, and a few other places, packing establishments are widely distributed over the country, and in many cases they handle a local product. The number of such establishments in the United States in 1925 was more than 1,200.

Germany produces meat products, including large quantities of both beef and pork, for domestic consumption. The exports are negligible. And this country has about reached its capacity under present conditions. There has been a marked change in the methods of the business since the close of the War. In 1914 the pork business was highly industrialized and production was


WORLD
SWINE
NUMBER
EACH DOT REPRESENTS 100,000
UNITED STATES 37%
GERMAN EMPIRE 16%
RUSSIAN EMPIRE 10%
AUSTRIA HUNGARY 9%
FRANCE 4%
UNIT KINGD. 2%
CANADA 2%
ARGENTINA 2%
DENMARK 2%
REMAINDER 16%
WORLD TOTAL
162,800,000 HEAD

From Finch and Baker, Geography of the World's Agriculture

Distribution of swine in the world

on a quantity basis. Before the War the abundant supply of cheap Russian barley was an enormous asset to the industry. The young pigs "were started on skimmed milk, fostered with alfalfa and other pasturage, and later finished off with barley and potatoes. Today the German farmer has neither the skimmed milk nor the grains with which to feed the mature animals."[3] In the case of beef, Germany has also been an importer.

U. S. Department of Agriculture

Sides of beef in cold storage

Before the War, Denmark, France, and Sweden, in the order named, were the chief sources of supply; but since 1920 Argentine has been the chief source. The rapid rise of the import trade seems to indicate that Germany is less able now to take care of domestic needs than before the War.

France is also a large importer of both beef and pork; the

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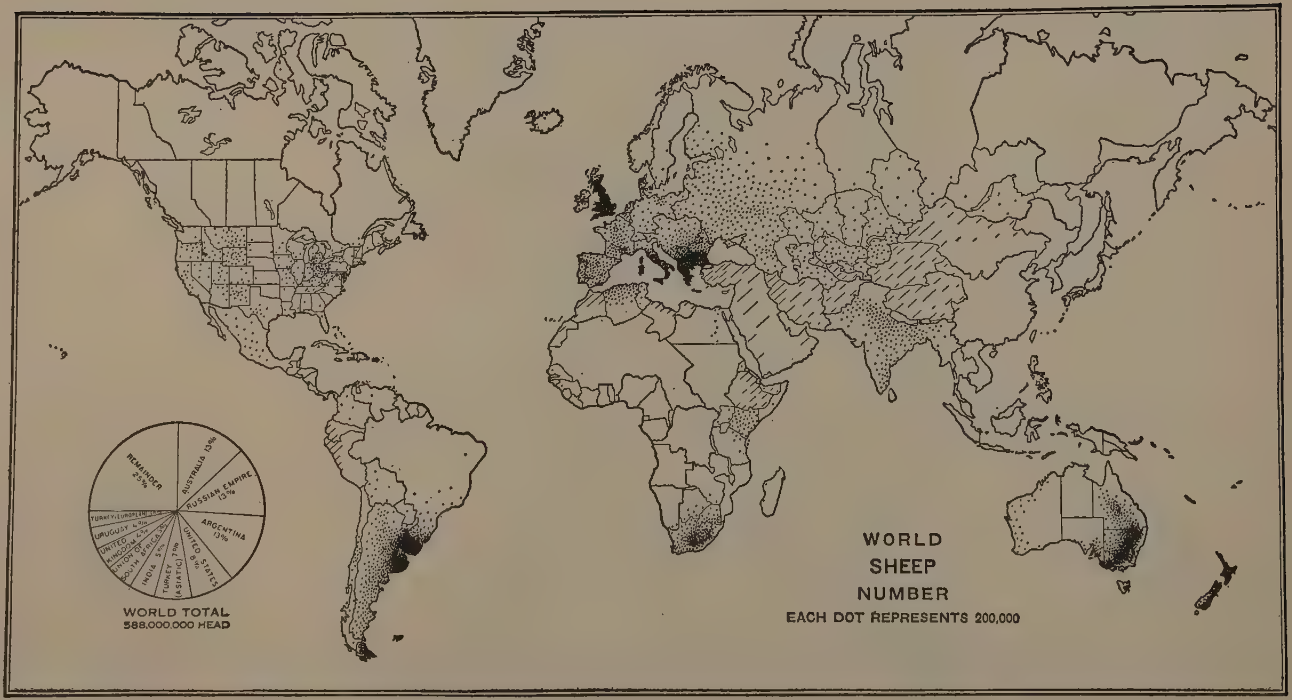
[3] *China,* Trade Promotion Series No. 26, p. 255.


WORLD
SHEEP
NUMBER
EACH DOT REPRESENTS 200,000
REMAINDER 25%
AUSTRALIA 13%
RUSSIAN EMPIRE 13%
ARGENTINA 13%
UNITED STATES 8%
TURKEY (ASIATIC) 7%
INDIA 5%
UNION OF SOUTH AFRICA 5%
UNITED KINGDOM 4%
URUGUAY 4%
TURKEY (EUROPEAN)
WORLD TOTAL
588,000,000 HEAD

From Finch and Baker, Geography of the World's Agriculture

Distribution of sheep in the world

imports of the former amounted to 250,000,000 pounds in 1925 and 57,000,000 pounds of the latter, although this country now exports small quantities of both products. Before the War France was largely self-sustaining with respect to meat products, the total imports amounting to only 81,000,000 pounds. The policy of protection gradually built up the home industry. With reference to pork, the prewar supplies came from the Netherlands, Belgium, and Sweden, and the imports of salt pork were obtained chiefly from the United Kingdom, Germany, Belgium, and Ireland. Since the War, beef has been supplied to the French market largely from Argentine, Uruguay, Brazil, and through the United Kingdom. As with Germany, France has no surplus for export and must rely upon the outside world to make up the deficiencies of home production. Russia and Italy produce for domestic consumption with little or nothing for export.

THE UNITED KINGDOM AS A MARKET FOR MEAT

This country is the largest importer of meats and meat products in the world, and it is also something of a reëxport market. The total imports of beef and its products in 1925 amounted to more than 1,854,000,000 pounds, and of pork and pork products more than 1,300,000,000. Britain also consumes over 500,000,000 pounds of mutton annually, obtained largely from New Zealand, Australia, and Argentine. Practically every economic factor in the United Kingdom is unfavorable to a large domestic production of meat products. The country is chiefly engaged in manufacture and trade, and the industrial forces are organized for these purposes. Moreover, the country is small and densely populated: some 47,000,000 people live within an area of 121,600 square miles, a region less than half the size of Texas. There is very little land available for a further extension of the industry. For some years Britain has not been able to supply more than from 50 to 60 per cent of domestic needs. On the other hand, the extensive commercial organization, including investments abroad in ranches and meat-packing plants, and shipping especially adapted to the meat trade, add to the advantages of import. The country has about reached its capacity for production, and if population continues to increase the meat supply must come more and more from the outside world.

At present the principal sources of supply of bacon are Denmark, the United States, and Canada, in the order named, and of hams and lard, chiefly the United States. New Zealand is the principal source of mutton, although large shipments are made from Argentine, Australia and Uruguay, given in the order of importance. About 70 per cent of the fresh and frozen beef is obtained from Argentine, and the balance is supplied for the most part by Uruguay, Australia, and New Zealand. Since these various countries look to the United Kingdom as their principal customer, the economic conditions in that country are an important factor in determining the prosperity of their meat trade.

COUNTRIES OF SURPLUS PRODUCTION

Argentine.—Until about 1880 the livestock industry of Argentine was represented only by the large herds of wild cattle which roamed the pampas, and which were hunted for tallow and hides —a condition which prevailed at one time in Texas, and even more recently in Colombia and Venezuela. The development of an orderly business for the supply of distant markets depended on the establishment of a settled government in this part of Latin America, because the industry required for its development the investment of foreign capital, not only in the opening of plantations, but in the building of railroads and the establishment of packing houses. The development of this industry both in its farming, and in its manufacturing and merchandising aspects has been accomplished largely by investments from the United Kingdom and the United States. Funds from the former have been invested chiefly in railroad building and in farming lands, although some investments are in packing plants; and the ownership of ocean shipping is largely in the hands of the British—a situation which is sometimes embarrassing to the American packers in Latin America. In 1923 over £232,000,000 of British capital were invested in the railways of Argentine. This made possible the opening of the interior and the development of cattle raising on a large scale. In addition, a number of foreign land companies have engaged in the raising of livestock, and there has been a large foreign investment in banking facilities, including two large American banks. In 1923, four large American companies had a capital in the Argentine packing industry amounting to about $40,000,000, and this says nothing of the investment of several English and local companies.

The growth of the packing business was not only a matter of the establishment of orderly government, and of building railways and opening of plantations, but of the discovery of effective means of transporting fresh meat long distances. The capacity of the country for stock raising far exceeded the possible home demand for meat. Access to foreign markets was an indispensable condition to growth. This was made possible by the introduction of methods of artificial refrigeration. Some trade of this description, between the United States and England, began in 1874, but the methods were very crude, and what was more significant, the prejudices against refrigerated meat militated against a rapid extension of this kind of business. Some of the early experiments in the transatlantic meat trade involved the freezing rather than the chilling of the product. The meat was frozen hard by using a solution of ice and salt and in this state shipped to the Smithfield Market. Later developments proved that chilling was a satisfactory method of preservation. The growing success of the new methods of transportation gave Argentine its real opportunity for development. But the next step was to improve the quality of the meat because the English market was selective.

Some domestic, and even a little export, trade existed before the introduction of refrigeration. For years, some of the Latin American countries manufactured a salted and dried product known as "jerked beef." This material still plays a part in the domestic trade of some South American countries. Quality of meat was not a factor in preparing "jerked beef," but it was of the utmost importance when the trade turned to the refrigerated product. Thus, the next step in Argentine was to improve the grade of the stock. During the fifteen years prior to 1914, upwards of 45,000 animals, including cattle, sheep, horses, and pigs, were imported for this purpose.

Although Argentine is now a large exporter of meat, the country is still much below its real capacity for production. In 1923 Argentine contained about 37,000,000 cattle, 30,000,000 sheep, and 1,400,000 hogs. There has been a marked decline in the number of sheep in the last dozen years, which is largely due to the competition of other kinds of agriculture. Sheep cannot be raised on high-priced land, and with the growth of wheat and cattle raising, they must be removed to more distant parts of the country. This seems to be taking place. At any rate, while sheep raising in some of the more northern sections is on the decline, it is beginning to grow in the south and in Patagonia, and packing plants have recently been established in that region.

Department of Immigration of Canada

Cattle on the plains of western Canada

A considerable extension of the area devoted to livestock is possible with the further development of irrigation. Thus, "as more land is irrigated for farming some persons suppose that the amount of stock will diminish; but Martinez, the leading authority, states that 50,000 square leagues will remain exclusively for breeding. This extent of territory will support 40,000,000 horned cattle and 200,000,000 sheep, besides the millions which would be raised in the cultivated districts on the intensive principle. Patagonia has large regions suited only for stock raising."[4] This indicates that the country has by no means reached its capacity fcr production.

A large amount of the success of Argentine as a cattle-raising country has been due to the use of alfalfa. It can penetrate into the semiarid soil and draw up moisture, and it has thus made possible the development of much of the waste land without the aid of irrigation. It has a higher animal-carrying capacity than the native grasses; in fact, it is maintained that an acre will support from one to two animals, while about eight acres are required with grass feeding. Moreover, alfalfa has the advantages of both a long yield and a long harvest. From four to eight cuttings a year are possible, and in certain favored localities it will grow more than ten years without replanting. Alfalfa brings cattle to maturity quicker than native grasses. These various factors, taken in connection with its drought-resisting qualities, have made it a valuable crop.

The bordering nations, Uruguay, Paraguay, and Brazil, are to all intents and purposes a part of the stock-raising area, of which Argentine is only one section. Uruguay has nearly reached its maximum production. The growing of alfalfa has not been a success, due to the fact that the subsoil is not suitable to its growth; but native grasses are available throughout the year, and continuous grazing is possible. But the country is relatively small and most of the land has been appropriated.

Conditions are very different in south Brazil, which offers great opportunities for the further development of stock raising. The country produces enormous corn crops and possesses vast pasturage regions. In some regions the open-range system still prevails; and cattle roam for great distances without care or attention. As yet the ranchman has hardly begun to tap the real productive capacity of this country. Somewhat the same condition applies in Paraguay. It is estimated that there are now about 5,000,000 cattle in this region, whereas the country could easily support eight times that number.

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[4] Annie S. Peck, *Industrial and Commercial South America,* p. 313.

Other regions in South America have vast stretches of land which may be used for stock raising when the time comes. The Bolivian areas are as yet inaccessible; and this applies to much of the land in Venezuela and Colombia; thus far ranchers and packers have paid little attention to these countries. In Colombia the government has given financial aid to the establishment of packing plants, but the organized effort of large companies, similar to those in Argentine, is required for the promotion of the industry. It is maintained that Venezuela is capable of supporting 50,000,000 head of cattle under a system of organized agriculture. While extensive grazing land affords good pasturage, there are but two short grazing seasons during the year. Much work must be done before the country can be put in a condition for capacity production, and this includes irrigation in some cases and drainage in others, and the opening of the country by transportation. As yet Venezuela has less than 700 miles of railway, and most of this either parallels the coast or connects some interior point with a port. All in all, South America offers the prospect of vast development of stock raising when the need arises, but much capital must be invested in the undeveloped regions before this expansion can occur.

New Zealand.—This country is one of the few large surplus producing areas. The principal export is mutton, although in some years New Zealand ships from fifty to eighty million pounds of beef. The export of pork and bacon is of little importance.

Both New Zealand and Australia labor under several great handicaps; the great distance from the consuming markets is one of the more important. It is rather remarkable that with the enormous population of Asia, all of which is inadequately supplied with meat, that the producers of Australia and New Zealand should be compelled to look to the more distant markets of Europe; we have already given the reasons for this condition.

Until about 1882 sheep were raised in New Zealand only for wool. Due to the longer distance, the problem of transporting meat to Europe involved even greater handicaps than in the case of Argentine. But the development of methods of refrigeration stimulated production in Australia and New Zealand, as in other parts of the world. The earliest shipment from Australia to England was in 1880, and two years later export began from New Zealand. In this country meat and wool are joint products and the problem of the breeder is to discover a variety of animals which will best serve the joint purpose. Thus, according to the local authorities, "the most profitable sheep for New Zealand is that which combines the best fleece and the most suitable carcass for freezing purposes, together with early maturity. . . . This is a class of sheep which some sheep-breeders have set themselves to produce."[5] Britain was the original source of the breeding animals, and naturally, the strains in the islands are like those of the place of origin. The merino has been bred for years in South Island, and the Romney in North Island. But there are indications that the Southdown type is rising in importance for fat lamb production. Although the islands now contain a large number of meat-producing animals, they are still below producing capacity. In 1923 New Zealand contained more than 23 million sheep, and about 3,400,000 cattle. The production of hogs was of little importance, the number being 400,000.

Australia.—This continent is primarily a producer of sheep and wool, although cattle raising seems to be making some gains. As with New Zealand, the production of hogs is of relatively small importance. In 1923 the farms of this country contained nearly 79,000,000 sheep, and over 14,000,000 cattle, and somewhat less than a million pigs. Mutton and lamb and wool are joint products, and the price of wool is often the deciding factor with respect to the product which goes to market. If the price of wool declines, and the carrying charges for sheep are high, meat is sent to market in larger proportions. Production conditions elsewhere in the world have much to do with the ups and downs of the Australian market both for meat and for wool.

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[5] *New Zealand Official Year Book,* 1903, p. 599.

The great distance from the consuming markets often militates against the sale of Australian products. This is more particularly the case with cattle products than with those of sheep, although in the latter, Australia often feels the competition from Latin America; this is notably the case with beef. Freight charges are higher for the Australian than for the Latin American products, and in addition, due to the greater distance, the Australian products must be frozen to stand the long journey to market. Because of these difficulties this country has at times urged a preference for its products in the markets of Britain. Failing this, the next best thing was to urge the home government to grant an export bounty. Thus the real issue was whether the extra cost of delivering meat in English markets should be borne by British consumers, or by Australian tax-payers. The possibilities for the further extension of stock raising in this area

Australian Tourist Bureau

Sheep ranching in South Australia

depend largely on the development of more adequate marketing arrangements. The country needs more railway facilities, and provisions for conserving food and water supply. Competitive conditions in Latin America are a check upon the growth of the meat trade of Australia; the further development of South American resources will continue as a threat to expansion in this part of the world.

The Union of South Africa.—Several regions in Africa present facilities for the future growth of ranching. The Sudan, which covers about a million square miles, is a fine pastoral country; but scarcely anything has been done to develop its resources. Rhodesia offers some advantages, but lack of water is a present handicap. It is claimed that the underground supplies are abundant, and that these may be tapped with a slight expense for boring. Granted a water supply, the dryness of the climate is an advantage, because the cattle are less liable to disease.

Some authorities maintain that Rhodesia could support 10,000,000 head of cattle, whereas the present number is less than a million. At present, the east coastal lands along the southern tip of the continent are the most active producers. Cheap land and extensive grazing throughout the year are promising advantages, but the Union suffers along with Australia and New Zealand from world competitive conditions. The present capacity for production, considering all regions together, exceeds consumption, at least on the present price level; the advantage in this struggle lies with the countries which have the most highly organized industries, and in which the cost of producing and marketing are least. A rise of price would probably stimulate further production, and cause more trouble for producers in all parts of the world. The government of the Union of South Africa has tried to meet the situation by legislative aid, and some of the proposals are remarkably similar to relief measures urged recently in the United States. During the postwar readjustment period, in 1923, the government passed a Beef Bounties Act which granted a fractional cent a pound on the live weight of all cattle exported. Cold-storage houses are also regulated, and the policy contained in another proposed measure is not far removed from our own McNary-Haugen Bill. According to the plan "a levy of 2s. (about $.50) per head would be made on all slaughtered stock, to be deducted from the sale of the cattle by the organization (of distributors of livestock), the money obtained to be used in the construction of a packing plant, and to meet overhead. Under this scheme the stabilization of prices would be based upon the supply and demand of the world's market and the prices would be subject to monthly revision."[6] Evidently, the equalization fee, or one of its modifications, has reached South Africa.

During the War period, the exports of beef from South Africa rose rapidly, reaching more than 50,000,000 pounds in 1917, but the industry has not been able to stand postwar competition. The exports are now less than a million pounds a year. This sudden contraction of the export business, after the brief period of War prosperity, is the reason for the demand for government aid.

Denmark.—This country is the world prodigy in the meat business. It seems incomprehensible that a little country, with an area of only 16,500 square miles, that is less than the combined area of Vermont and New Hampshire, and with a population of only 3,400,000, should be the second largest exporter in the world of pork and its products, and a serious competitor of the United States; yet, this is the fact. In 1925, Denmark shipped abroad more than 462,000,000 pounds of pork and pork products, which was more than one-third the amount exported by the United States.

These results have been achieved because of a careful study of the market conditions in the United Kingdom—the chief customer—and of the introduction of scientific methods of production and marketing. Denmark cannot afford to use any considerable portion of its limited area in the production of feedstuffs. The raw materials used for feeding are barley, corn, and skimmed milk. Most of the grain is imported. By systematic breeding, the Danish farmer succeeds in obtaining two litters each year from a sow, with from 9 to 12 pigs at each farrowing. At this rate, he is able to send from three to four million hogs a year to the export slaughter houses.

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[6] Trade Promotion Series Bulletin No. 26, p. 140.

The growth of the Danish export meat business dates back to about 1887. In that year, Germany, in order to protect her own hog-raising industry, prohibited the import of live and dressed hogs. Danish producers were forced to find another market and they turned to the United Kingdom. Meanwhile, these farmers encountered about the same difficulties with middleman's charges as producers in the United States. The Danish solution was to organize coöperative societies, both for production and for marketing. The associations sent representatives to study British markets; they imported Yorkshire boars and sows; they sent their hogs to the coöperatives; and, in addition, they kept accurate records of feeding and breeding. The outcome was not only the production of an animal which was remarkably well adapted to the needs of British markets, but the development of surprising uniformity in size and quality of the product. "Looking at a string of them [hogs] hanging on an overhead rack, the noses of the pigs are in almost perfect alignment, varying no more than an inch, and their weight and size in general are the same. Even in color there is the same similarity; all are white, clear and clean."[7] The purpose in breeding is to give a long body, a long bacon side, with as little offal as possible. The product is carefully inspected, and animals which do not conform to the standards are either slaughtered for domestic consumption, or exported to regions which are not as particular as the British in the appearance of the commodity.

The work of the associations gives an interesting example of the operation of the coöperative principle. The farmer agrees to ship hogs to the association. The central organization fixes the prices a week in advance and the farmer receives his compensation on this basis. The various coöperative slaughtering houses have further federated into the Danish Bacon Company which controls the selling in England. If the organization makes a profit this income is divided equally among shippers and customers. Losses are assessed against the packing houses in proportion to shipments.

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[7] *Ibid.*, p. 104.

DAIRY AND POULTRY PRODUCTS

From country to country there is a considerable trade in these products. As with meats, Britain is one of the principal importers. Denmark is the largest source of butter shipped into Great Britain, but supplies are also obtained from Russia, Sweden, France, and the Netherlands. Canada, New Zealand, and some of the continental countries of Europe supply cheese; and eggs are imported from Denmark, Canada, and Egypt among others.

In recent years, Italy has been a large exporter of eggs; about 47 million pounds were sent out in 1926; China is one of the largest of the world exporters of eggs and egg products. Shipments of albumen and yolk in 1925 amounted to 76 million pounds, and of fresh and preserved eggs to 65 million pounds. The albumen and yolk are taken chiefly by the United States and England, although small quantities find their way into France and Germany. About 75 per cent of the fresh and preserved eggs exported from China are taken by Japan; England and the United States import Chinese cold-storage eggs.

The imported egg products are used in the United States chiefly in certain manufacturing industries, although the bakers sometimes use dried whole eggs and yolks in the manufacture of pies and pastry. The tanner uses liquid eggs and yolk, and textile producers make use of albumen in printing certain kinds of cotton cloth which do not readily absorb the pigment. Albumen is used also for the finishing of paper, thickening of ink, and in the manufacture of sensitized photographic plates.

DRAFT ANIMALS

All people above the stage of hoe culture must make use of draft animals. Beasts of burden are a kind of labor-saving, or labor-multiplying device, because the worker of the soil can accomplish more with them than without them. Thus, no matter how expensive the land, or how crowded the population, the community must make some arrangements for the maintenance of draft animals. In fact, since men working with the aid of animals can produce a larger return, it is the part of economy to use them. Horses and mules are the customary work animals in countries which can afford to use them. Some 15,000,000 horses and nearly 6,000,000 mules are on the farms of the United States. The introduction of farm traction machinery during the last ten years has caused some reduction in the number of horses, but the mule has a little more than held his own. Horses are used in most European countries, although in proportion to agricultural work, the number is less than in this country, and the mule is less in favor than in the United States. Only 476,000 were in use in France in 1923, and only 31,000 in Germany. Oxen are still used in various parts of Europe, and this animal is also employed in some places at harvest to tread out the grain on the threshing floor.

Many kinds of animals have played a part in helping man develop trade. Camels have been in service from time immemorial. This animal is a native of Asia and is used in certain parts of that continent as a means of transportation. It has long been used in the desert areas of Africa. Camels have great advantages as beasts of burden. They can carry a heavier load than most other creatures. The single-humped animal will bear upwards of 350 pounds, and the double-humped creature nearly twice that amount. These beasts have great endurance and can travel long distances on a minimum of feed and water.

In Peru, llamas are employed as beasts of burden. They are sure-footed, they can travel for considerable distances without water, they usually forage for themselves along the way, and they are able to endure lower altitudes than some other mountain animals. The llama, however, cannot bear heavy burdens —not more than 50 to 60 pounds, and the average is about 40 pounds. When used for transportation purposes, only half the animals are loaded each day, in order to give the other half a rest. The elephant is sometimes used for the carriage of freight in marshy, tropical regions. The carrying capacity is greater than that of other beasts of burden, but the elephant is a big eater, and this is sometimes a disadvantage. Yaks, a species of oxen, are the carriers in some portions of Asia, and the packman still has his day in some parts of the Far Eastern world.

QUESTIONS

1. In what ways do domestic animals serve man and his industries? Name the most important animal products. Would it be necessary to organize our industrial life on a different basis from what exists today if we did not have domestic animals? Why?

2. Why do not all people consume meat? What substitutes take the place of meat for those who are not meat eaters? Are these other substances adequate substitutes? What is the test?

3. What countries of the world are the chief exporters of meat? What conditions make possible the position of these countries as exporters?

4. Discuss the conditions of livestock production in Europe. In what ways do those conditions differ from conditions in the United States?

5. Are we in the United States approaching the limit of livestock production? Why?

6. Discuss the conditions of meat production and meat trade in the United Kingdom.

7. What conditions have favored the development of the livestock industry and the expansion of the meat trade of Argentine? Do you think that Argentine will continue, for many years, to be an important surplus meat-producing country? Why?

8. Why do not the Argentine people finance the meat-packing industry in their country? Where does the capital come from chiefly for this purpose? Why have capitalists in these particular countries taken the initiative in Argentine meat business?

9. What has been the significance of the use of alfalfa as a foodstuff in Argentine?

10. Estimate the possible future of the livestock industry in Latin America.

11. Why must Australia and New Zealand look to Europe as the chief consumer of the meat products when the populous areas of Asia are so much nearer, and so much more populous?

12. What problems are involved in marketing meat products from Australia and New Zealand which are not involved in marketing from South America? Is there a solution for these problems?

13. How does the fact that wool and mutton are joint products affect the production and marketing of sheep and wool?

14. Estimate the future of the livestock industry in Africa.

15. What factors in the international economic organization decide in what possible surplus-producing areas the meat trade is to arise?

16. Explain the high relative development of packing industry in Denmark.

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CHAPTER XVII

COFFEE, TEA, AND COCOA

If one asks why coffee, tea, and cocoa were introduced as articles of consumption the answer is that, at least in the earlier years of their history, they appealed to the fancy and curiosity of the people who could afford to consume them; many were led to consumption by a kind of imitation, and some desired the stimulating effects. None of these beverages, except cocoa, has a food value; for most people the desire for coffee is an acquired taste, and the consumption of tea, at least in some parts of the world, is only a polite way of drinking hot water.

INTRODUCTION OF COFFEE

Popular legends seem to emphasize the stimulating effects of coffee as the original cause for its use. In the third century, a group of monks, fleeing from persecution in Egypt, took refuge in Abyssinia. One of their number came upon a herd of sheep and goats, which, instead of going to rest at night, as is the custom of peaceful animals, frisked and frolicked the whole night through. After some investigation one of the monks discovered that their sleeplessness was caused by feeding on certain shrubs. Experimenting with himself, he learned that he was affected in the same way after chewing the buds of the plant. As with the legends of light and darkness, there are a number of versions of this story. In the city of Aden there lived a drowsy mufti by the name of Jemal-ed-din who discovered, also, that coffee "disposed him to keep awake, as well as to a more lively exercise of his spiritual duties." Upon Jemal's recommendation coffee was introduced at Mecca and Medina; and it came into use subsequently at Cairo.

Coffee was first consumed not as a beverage but in the form of a paste. It was learned subsequently that the stimulating virtues were retained when the paste was dissolved in hot water, and this also afforded a somewhat more palatable form of consumption. The introduction of coffee into rather general use was not without opposition, experiencing, in this respect the early history of tobacco, which was denounced by King James as "a custom loathsome to the eye, hurtful to the nose, harmful to the brain, dangerous to the lungs, and in the black stinking fumes thereof nearest resembling the horrible Stygian smoke of the pit that is bottomless." The Mohammedans believed that coffee was an intoxicant, and it was therefore proscribed by the Koran. But desire was stronger than law, and the coffee-drinking habit continued to grow. The first coffeehouses were established in Constantinople about the middle of the sixteenth century, and here they caused trouble, chiefly because they became the rendezvous of people who neglected the mosques. England encountered an analagous experience shortly after the introduction of coffeehouses in 1652. More than three thousand of these places were said to have been in operation in London during the reign of Charles II, and they became such a nuisance as hives of gossip and political intrigue that the king tried to suppress them by proclamation.

It might be remarked in passing that the three beverages which form the subject of this chapter were introduced into Great Britain almost contemporaneously. Cocoa was the first to make an appearance. It was brought to Spain by her explorers, who had learned of its virtues in South America. Coffee came from Arabia, by way of Constantinople; and the Dutch brought tea from China.

Arabia was the earliest source of coffee shipped to Europe, hence the name Mocha, which was once famous in the trade. In 1690, seed was carried to Java where soil and climate were admirably adapted to the coffee plant. About 1718 the Dutch brought the seed to Surinam, and from this place cultivation spread to a number of the West Indian Islands, and from thence to Central America and Brazil. In recent years the coffee industry has grown so rapidly in the last-named country that it now dominates the coffee trade of the world.

As with all other commodities which enter international commerce, competitive conditions largely determine the prosperity or failure of producers in the various regions. The rise of Brazilian coffee brought hardships to producers elsewhere, and even to Brazilian planters, who now find themselves with an excess of producing capacity, and seek to escape from the burdens of surplus production by government aid in marketing the output. The planted area of the world could now supply international markets with much more coffee than could be consumed, and besides, the present growing regions could add enormously to their capacity if consumers could be found.

The per capita consumption of coffee varies greatly from country to country. It is highest in Holland, the Netherlands, and the United States. In this country, the net per capita import has risen steadily from about 3 pounds in 1830 to nearly 7 pounds in 1860, to more than 8 pounds in 1890, and it was about 12.5 pounds in 1926. Thus the consumption grows in spite of the introduction of substitutes, and what appears to be increasing abstinence on the part of some persons. Consumption is relatively small in the United Kingdom, Italy, and France, and in Russia it is less than one pound per capita.

COFFEE-PRODUCING COUNTRIES

While a considerable amount of coffee is still produced in the Far East, Brazil has become the world's chief producer. The crop is raised chiefly in four states of South Brazil, namely São Paulo, Rio de Janeiro, Minas Geraes, and Espirito Santo. But the harvest is most important in São Paulo, and the city of the same name is the chief coffee port of the world, the business of the city being largely organized around the coffee industry. During the last few years the crop of Brazil has amounted to between 70 and 80 per cent of the total for the world.

Although the coffee plant was introduced into Brazil about the middle of the eighteenth century, the rise of the modern industry did not begin until about 1900. Growing conditions are particularly favorable in Brazil. The trees require a rich soil, plenty of rainfall, and an elevation of about 1,500 feet above the sea. All these conditions are met satisfactorily in South Brazil. The planter uses virgin soil. He makes preparation for the crop by clearing the forest. The seed is first sown in the clearings, and in six or eight months the young tree is transplanted to its permanent location. Due to the great fertility of the soil, and to the abundance of moisture the fields would soon be overgrown by native plant life unless the plantation were constantly cultivated. Labor is required not only for this purpose but in pruning the trees, which are not allowed to grow above 20 or 25 feet, and in picking and preparing the coffee for market. Plantations are usually large; some contain from 25,000 to 50,000 trees, and there are a few large establishments

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Sun drying of coffee beans at Santos, Brazil

with more than 1,000,000 trees. All in all, the country is said to contain from a billion to a billion and a half producing coffee trees.

Evidently, the growing of coffee has become an organized business. Hitherto, the planter has depended largely on immigrant labor, especially Italian, but some of the work is done by negroes and mestizos. The workmen live on the plantation in houses provided by the owner.

Harvest begins in April or May and lasts until August. The berries are either picked from the tree and placed in baskets, or dropped on sheets, whence they are collected by other workers. The first step in preparation for the market is to transport the coffee to a central station where it is washed and soaked, and put through a pulping machine. It is washed again and spread out in the drying yards. This process requires several days in which the product is constantly turned with a wooden rake. With further cleaning, to remove the thin husk, and polishing, the product is ready for the market.

We have described in a previous chapter the process of valorization which was designed to assist the planter in marketing his surplus crop. This scheme has been employed on various occasions and now seems to be a permanent institution. In substance, the plan is for the government to buy the surplus coffee and store it, usually in foreign ports, and to sell from this stock when this can be done without depressing the market. The position of Brazil as a coffee producer is shown in the following table:

WORLD TRADE IN COFFEE, 1926

Country	*Pounds*
Brazil	1,783,339,000
Colombia	257,722,000
Netherlands East Indies	153,725,000
Venezuela	118,254,000
Salvador	70,689,000
All others	480,297,000
TOTAL	2,864,026,000

The table indicates that Brazil is not the only Latin American country which produces coffee. In fact, certain quantities are produced in nearly a dozen countries. In Ecuador, it is usually the third or fourth most important export, Chile being one of the chief consumers. It ranks first as an export of Colombia, Guatemala, Salvador, and Costa Rica. Considerable quantities are sent out from some of the British West Indies, from Mexico, Haiti, and Porto Rico. Coffee is also produced on a rather large scale in the Netherlands, East Indies, in the state of Mysore and in the Nilgiri Hills in India, and in several places in Africa. The supply for the United States comes chiefly from Latin America, although small quantities are brought in from the Far East. Great Britain imports from Brazil, Costa Rica, Colombia, Mexico, and India, among others, some twenty countries contributing to her supply.

TEAS

India, Ceylon, and China supply the world with most of its tea. Until about 1833 China was the sole source of supply. But in that year the cultivation of the plant was introduced into Assam in India. Tea is a cultivated plant. The tree is closely pruned towards the end of February or first of March. In about eight weeks a fresh growth, from four to eight inches long, makes its appearance over the bush. These "flushes" occur frequently during the season, and the job of the worker is to pluck the buds and a few tender leaves. The product of this harvest is then carried to stations for further preparation, which consists of withering, rolling, fermenting, and firing. Subsequently, the small leaves are separated from the larger ones by passing through a sieve. The product is then graded for the market.

Green and black teas are prepared by a slightly different process. With the former, the leaves are roasted immediately after gathering, but they are not fermented. The kind of tea which meets the highest favor in the market depends upon the tastes of consumers, and there is no accounting for that taste, nor is there an absolute test of aroma or flavor. The Chinese product is sometimes said to be inferior, partly because it is not as carefully prepared as the teas of India, and partly because the rolling is done by hand or by bare feet, whereas in India tea making is largely a factory industry, where great attention is given to sanitary conditions of manufacture. The defenders of the Chinese product would probably deny that consumers encounter any danger from contamination because of Chinese methods; they would insist that if harmful bacteria are contained in the product the immersion of the tea in boiling water would destroy such life. Moreover, "it is well known that, apart from boiling, an infusion of tea is antagonistic to the life and development of micro-organisms, and this appears to be specially the case with the typhoid organism."[1] The Chinese connoisseur would probably contend, also, that the fine qualities of tea are partly destroyed by mechanical processes of production. The Chinese product is said to be less astringent, and less likely to derange the digestion than the product of India. No one seems to deny this argument. Of course, with "brewing" for only

Publishers' Photo Service

Picking tea in Japan

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[1] A. Ibbetson, *Tea*, p. 12.

a few minutes only small quantities of tannin enter the infusion, and this seems to be the recourse of those who find that Indian teas disturb their digestive systems.

In the competitive struggle between the Indian and Chinese products, the growers of the latter country have the great advantage of an enormous home market. British inhabitants of Australasia are among the largest per capita consumers in the world, the amount being about 7.5 pounds. Consumption in the United Kingdom is 6.4 pounds per capita, in Canada 4.3 pounds, in Holland 2 pounds, and in the United States 1.3 pounds. As with coffee, the world producing capacity greatly exceeds the present possibilities of consumption, and cultivation can be much further extended when necessary. The amount exported from the leading countries is shown in the appended table.

Export of Tea from the Leading Countries, 1925

Country	Pounds	Value
India	325,733,000	$98,343,000
Ceylon	217,184,000	77,442,000
Netherlands East Indies	110,648,000	29,867,000
China	109,134,000	18,423,000
Japan	23,775,000	5,707,000

CACAO

The name given in this title is the raw material of commerce from which are manufactured innumerable products of chocolate and cocoa. The latter substance is often confused with several others, having names, the spelling of which is not far different from that of cocoa. The coconut, sometimes spelled cocoanut, is the fruit of a palm (*cocos nucifera*) which attains a height of from 60 to 80 feet. At the top are tufts of leaves at the base of which the nuts hang in clusters. As we shall see later, the coconut is an important article of commerce.

Coca (*Erythroxylum coca*), with which the name cocoa is sometimes confused, is the dried leaf of a plant which thrives chiefly in Peru and Bolivia. This shrub grows usually six feet high. While it was originally a wild plant, it is now cultivated in the districts of Otuzco, Huamachuco, Cuzco, and Ayacucho in Peru, and to some extent in Bolivia. The best conditions of growth are found in the valleys from 3,000 to 7,000 feet above sea level, where the range of temperature is from 60 to 85 degrees. The leaf has been chewed by the natives for centuries, often in religious ceremonies, and the Indians of the west coast of South America still consume the product. The chewing of coca is said to be "of great service on the plateau for unusual exertion, but injurious and stupefying if habitual."[2] Peru contains twenty small factories for the manufacture of materials from the shrub. Dried leaves are used in Europe and the United States in making tonics, for the extraction of alkaloid, and in the production of cocaine.

Cocoa is the product of a tree of the genus *theobroma,* the most important species of which is *theobroma cacao.* This substance was already in general consumption in Mexico at the time of the conquest of Cortez. It was reported that "he who consumes his cup of chocolate can march a whole day." The natives were attracted not only by the stimulating effect, but by the pleasant taste when flavored with vanilla and other materials. Montezuma seems to have had a voracious appetite for chocolate, if we can believe the historian Prescott, who is the authority for the statement that: "this beverage, if so it could be called, was served in golden goblets, with spoons of the same metal, or of tortoise shell, finely wrought. The emperor was exceedingly fond of it, to judge from the quantity, no less than fifty jars or pitchers, prepared for his own daily consumption. Two thousand more were allowed for that of his household."[3]

The cacao tree is a native of tropical America. The wild plant is found in the valleys of the Amazon and Orinoco. With respect to natural conditions, it is a most exacting tree. It requires more heat than coffee, but it cannot stand the continual blaze of the tropical sun. Thus, it seeks the shade of other trees. When cacao is a cultivated product the banana is sometimes used for shade purposes. It grows best in the low plains where it can obtain a great deal of moisture, and where perhaps it receives more protection from the winds than in the more exposed places. The pod is attached directly to the trunk by a slender stem which is easily broken. Thus, even granted other satisfactory conditions, the tree cannot thrive in regions of winds. This practically limits its home to the area of the doldrums, from 15 to 20 degrees on either side of the equator.

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[2] Annie S. Peck, *Industrial and Commercial South America,* p. 188.
[3] Quoted from J. C. Cunningham, *Products of the Empire,* p. 100.

The cacao is a spreading tree, which in nature reaches a height of not over 20 feet. The seeds, numbering about 50, are contained in a pod from 8 to 10 inches long. Immediately after picking, the bean is allowed to undergo some fermentation, partly to aid in the removal of the pulp, and partly to permit certain chemical changes which are thought to add to the quality of the product. After fermentation, the seeds are washed and dried, either in the sun or by a hot-air blast.

United Fruit Company

Shelling cocoa beans in Costa Rica

The manufacturer takes this raw material and converts it into many articles of commerce. The beans are roasted and crushed; the shells are then winnowed out leaving the fragments of the beans known as "nibs." If bitter chocolate is the purpose of manufacture, the nibs are first ground to a fine paste, and then sugar and extracts, usually vanilla, are added, and the mass is pressed into form suitable for sale. If the manufacturer produces cocoa, he presses the nibs to drive out the excess of oil, or treats the product with alkalies which act upon the oil and render the cocoa product suitable for mixing with water or milk. Both chocolate and cocoa are not only stimulating but nutritious foods. The former contains more nutriment than the latter, but it also contains too much fat to suit the taste of many people. The principal components of cacao are fats, starch, albuminoids, water, some mineral matter and theobromine. The first three substances predominate.

In many places, the production of cacao has become a large-scale plantation industry, and it is often carried on with foreign capital. In Ecuador, for example, a British company in 1914 operated some 100,000 acres with about 2,500,000 trees. Several other plantations contained from 100,000 to a million trees. Similar conditions prevail in Brazil. This country has an abundance of land which can be devoted to the crop when the proper time comes; but the business must be organized on a large scale if the operator is to make a profit. Although production has declined somewhat since 1825, the industry grew rapidly from 1913 to 1924. Exports in the former year were about 65,000,000 pounds, and about 151,000,000 pounds in the latter.

Cacao is produced in large quantities in about a dozen places in the world and in smaller amounts in double that number of regions. The greatest sources are San Thome and Principe, Ecuador, Brazil, Trinidad, the Gold Coast, Venezuela, and the Dominican Republic. Total world production is from five to six hundred million pounds, but it may vary greatly from year to year, due partly to conditions in the market, and partly to factors affecting the crop. The industry experiences years of overproduction and depression usually followed by periods of prosperity, and there is a tendency for planters to shift to something else when the production of cacao encounters unprofitable years. In Venezuela, for example, the low prices which have prevailed recently have caused some planters to shift from cacao to coffee, although they probably have not improved their condition by the change. The drift of laborers away from the agricultural areas is becoming a handicap to the industry. Several years ago, Ecuador was one of the three largest producers, but there has been a marked decline in production due to the ravages of two pests, namely, the "witch broom" which injures the trees, and the "monilia" disease which attacks only pods and blooms. In 1913 Ecuador exported about 92,000,000 pounds of cacao beans, but shipments were just about half this amount in 1926.

The United States is the largest consumer of cacao, and our supply is gathered in from practically all the large producing countries, although Brazil is the most important source. In 1925 that country sent us about 72,000,000 pounds, which was half her total export. Canada and the western countries of Europe take almost all the remainder of the world output. Apparently, the Far East has not yet learned to consume chocolate and cocoa because their imports are negligible. The producing countries are also large consumers. "In Central America and Mexico the breakfast food of the inhabitants from prehistoric times has been a preparation of Indian corn with the produce of the cacao tree; this is made into a porridge called "tiste," which is agreeable to the taste and nourishing, for a long journey can be made upon it."[4] A large percentage of the cacao taken by the importing countries is manufactured into cocoa and chocolate; but large quantities are used in the production of candies. Cocoa butter, obtained from pressing the oil from the beans, is a valuable article of commerce partly because, unlike most vegetable and animal oils, it does not readily become rancid. It can thus be used in medicinal preparations where this quality is particularly desired.

The land area of the world upon which the cacao tree can be successfully grown is not unlimited, but consumption will not overtake the world capacity for production for many years. In fact, in recent times the tendency has been towards overproduction—to such an extent that producers have discussed schemes of valorization similar to those which prevail for Brazilian coffee. But in the case of cacao such plans would be difficult to manage because of the wide diffusion of production. Producers are often spared the depressing effect of overproduction by an occasional blight or ravages of pest. But if the area is not unlimited there are still a number of regions which have a large prospective capacity for production. Mexico, for example, which was once a large producer, now exports little or no cacao, and grows only small quantities for home consumption. There are still undeveloped areas in other portions of Latin America, in Africa, and in the East Indies. Scientific studies into methods of production should add to the capacity of regions which are already under cultivation. What is particularly needed is the discovery of methods of protecting the trees against various pests, which have seriously curtailed the crops on various occasions.

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[4] *Bulletin of the Pan-American Union,* Vol. XXIV, p. 81.

YERBA MATÉ

In some of the South American countries this product serves all the purposes of tea. In fact, in some regions maté is more extensively consumed than tea is in England. Some 20,000,000 pounds are exported annually. Only small quantities are consumed in the United States. It is better known in some of the European countries, France being the largest consumer, followed by Germany, Italy, Spain, and Portugal. Paraguay, which is the principal producer, also exports maté to such neighboring countries as do not harvest the crop.

Maté is said to be as stimulating as coffee, but for many persons it is more easily digested. "It may be made like tea, but in its native haunts, the powder is put into a gourd called a maté, boiling water is poured on, and after steeping the liquid is drunk with a bombilla, a tube ending in an oval ball, with small holes to admit the liquid, but supposed to keep out the yerba."[5]

Yerba maté (*Ilex paraguayensis*) is the product of a bushy tree which grows from 12 to 25 feet in height. The tree grows very irregularly, sometimes with only a few trees to the acre, and at other times in numerous clumps. In preparation for consumption the leaves are cut, piled in the form of a hay stack, and smoked for several days. Leaves and small twigs are then reduced to a coarse powder. The industry is yet on a primitive basis; although the tree has been cultivated to some extent, most of the product is obtained from the virgin forest.

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[5] Peck, *op. cit.*, p. 342.

QUESTIONS

1. Why have coffee and tea been introduced as articles of consumption? It has been said that the taste for coffee with many people is an acquired taste. Why, then, do so many acquire it?
2. Are the people of all nations coffee drinkers? If not, where is coffee consumed? Why here and not elsewhere?
3. Describe the rise of coffee consumption.
4. How has the rise of coffee growing in Brazil affected the prosperity of coffee producers elsewhere in the world? Why has Brazilian competition produced this result? Cite other cases where the rise of a new industry has caused trouble for producers elsewhere in the world.
5. Can we explain why the per capita consumption of coffee is greater in some countries than in others?
6. Discuss the conditions of coffee production in Brazil.
7. What do you understand by the term "valorization of coffee"? Describe the operation of this plan. Do you think it will work in the long run? Why?
8. If prices are kept higher than competitive prices under some scheme of valorization why do not producers in other parts of the world increase their output immediately? Do you think they will increase their crop eventually? Why? How would this affect Brazilian valorization?
9. Compare the methods of production of tea in India and Ceylon and in China. Can you decide which method is "better." Why?
10. Can you explain why the per capita consumption of tea is much less in the United States than in Great Britain? Do habits, tastes, traditions, likes, and dislikes affect the demand for a commodity?
11. Explain what the following are: cacao; coca; coconuts.
12. Describe the rise of cacao as an article of commerce.
13. What are the most important commercial products obtained from cacao?
14. Do you think that it is possible to valorize cacao as the Brazilians have done with coffee? Why?
15. What is yerba maté? Since it is claimed that this commodity has all the stimulating effects of coffee without the deleterious effects, why is not yerba maté more widely consumed?

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CHAPTER XVIII

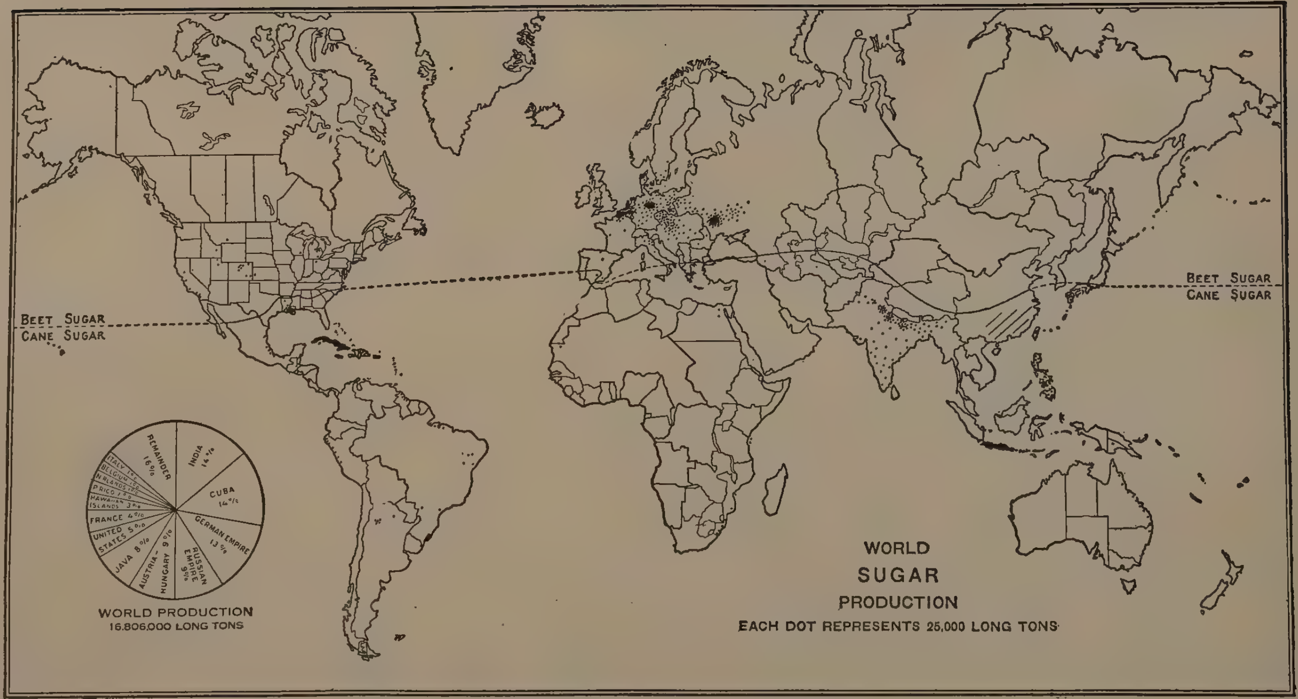
THE WORLD'S SUGAR RESOURCES

The sources of sugar are practically unlimited, but the economic elements of cost of production and the selling price of the finished product determine the kind of raw materials from which the substance is to be manufactured. At present, the materials from which practically all the world's sugar is manufactured are sugar cane and sugar beets. But varying quantities are gotten from certain fleshy roots, such as potatoes and carrots, from fruit juices, from milk, corn malt, and from the juices of maple trees, and from certain palms. Sugar is sometimes obtained from the stalk of broom corn (sorghum), but the difficulty of producing a crystalline product renders this material unimportant. Honey has been used for centuries for sweetening purposes.

HISTORY OF SUGAR

Syrups, and possibly sugar, have been produced from cane in India for several thousand years, but the products were very crude. Egyptians knew something of the art of refining and this art was taken to China and India. Manufacture was carried on by the Arabs, and under this influence the industry spread to many places. Venice, which at one time possessed a highly developed commercial organization, was the center of the world sugar trade. From this source small quantities were imported into England. Consumption, however, was necessarily restricted, due to the high price of the product. The increasing use of tea and coffee added something to the demand for sugar, and with the lowering of the price, as a result of the opening of the sugar lands of the New World, other uses were found.

It is significant that the art of refining had already been developed before the New World became available for the


BEET SUGAR
CANE SUGAR
BEET SUGAR
CANE SUGAR
REMAINDER 16%
INDIA 14%
CUBA 14%
GERMAN EMPIRE 13%
RUSSIAN EMPIRE 9%
AUSTRIA-HUNGARY 9%
JAVA 8%
UNITED STATES 5%
FRANCE 4%
HAWAIIAN ISLANDS 3%
P. RICO 1%
N'RLANDS 1%
BELGIUM 1%
ITALY 1%
WORLD PRODUCTION
16.806.000 LONG TONS
WORLD
SUGAR
PRODUCTION
EACH DOT REPRESENTS 25,000 LONG TONS

From Finch and Baker, Geography of the World's Agriculture

Production of sugar in the world

growing of cane, because the demand was already in existence and all that was necessary for the rapid development of the industry was production at a price which would bring the commodity within the means of ordinary consumers.

Within the last seventy years the sugar beet has become a successful rival of cane as a raw material in sugar making. This branch of the industry is the result of the discovery of Andreas Marggraf in 1747 which revealed the presence of sugar in beetroots. At this time the discovery had no commercial significance; cane supplied about all the sugar the world needed and there was no incentive for the development of mechanical processes for manufacture from beets. The Napoleonic wars, which disrupted European commerce, curtailed the Continental supply of many substances, sugar included, with the result that producers began to give attention to other materials than cane.

Franz Achard, a pupil of Marggraf, established a beet-sugar factory at Cunern near Breslau in 1801. The rise of prices during this period gave encouragement to the industry, notwithstanding the imperfections of manufacture, and beet-sugar factories were established not only in Germany but in France. The German industry was not able to stand the competition with cane sugar when settled times were restored, and practically passed out of existence, but in France, where the manufacture had been put on a more scientific basis, the manufacture continued, although on a small scale.

In 1840 only 4 per cent of the world's sugar was produced from beets. But from this time forward the industry continued to grow. The beet-sugar output was about 14 per cent of the total in 1850, and about 20 per cent of the total in 1860.

Until about 1875 the United States obtained its supply of sugar partly by manufacture from the cane grown in Louisiana, and partly by import. The cane-sugar industry in Louisiana originated in about 1751 when the Jesuits of Santo Domingo sent the plant, together with negroes who understood its cultivation, to their brothers in Louisiana. But the planters were profiting by the cultivation of indigo and were little interested in sugar until their crops were destroyed by insect pests in

1793 and 1794. In the latter year, Etienne Bore showed that the juice of Louisiana sugar cane could be made to crystallize, and he thereby laid the foundation of the North American sugar industry. Before the close of the century, Louisiana was able to supply the United States with a million pounds of sugar a year.

Although efforts had been made as early as 1830 to introduce the manufacture of beet sugar into the United States, lack of knowledge of processes of manufacture, and ignorance of the soil and climatic conditions under which beets could be profitably grown prevented success. Competition with imported sugar was also a handicap to the proposed industry. The erection of a well-equipped factory at Alvarado, California, gave an initial impulse to the manufacture. Aided subsequently by bounties granted by some states, by the experimental work of the Department of Agriculture, and not a little by the sugar bounty of the Federal government, which was in operation from July 1, 1891 to August 27, 1894, both the raising of the sugar beet and the manufacture of beet sugar were placed on a firm footing. Originally a far western industry, the growing of the sugar beet has spread to a number of western and middle states. Colorado and Michigan are now the largest producers, but large quantities are grown in California, Nebraska, Utah, Montana, Wyoming, and Ohio.

PRODUCTION OF CANE SUGAR

The introduction of sugar into the western world was the result of the enterprise of Portuguese and Spanish explorers during the fifteenth century. The plant was brought to Madeira in 1420, and to Santo Domingo in 1494. Cultivation soon spread to other settled portions of the West Indies and to the continent of South America. During the years before the American Revolution, the West Indies were the chief source of European supply. The sugar industry was organized under the plantation system. In the earliest years the work was done by native labor, but with growing prosperity, sugar producers found it necessary to rely more and more on slaves. After years of agitation slavery was finally abolished in British dominions in 1833. Since the cultivation of cane sugar required a large amount of cheap labor, this change brought depression to producers in the British West Indies, and it has only been in recent years, with the introduction of modern systems of cultivation, that the industry has regained some of its former prosperity.

Publishers' Photo Service

Cutting sugar cane on a Porto Rican plantation

Cane sugar can be grown successfully in many parts of the world. It requires rich soil and hot climate, but these conditions are met in so many places that the world's potential capacity for production far exceeds the present demands. In fact, one great problem at present is to take care of the excess of the producing lands.

This problem is probably more acute in Cuba than in any other place in the world. The prosperity of the country depends on two commercial crops, namely, tobacco and sugar, but the latter usually composes from 80 to 90 per cent of the exports, or in actual figures $237,000,000 in 1926 compared with a total export commerce of about $290,000,000. Thus, a depression in sugar is a serious matter in the island.

Conditions in Cuba are ideal for the production of cane. The climate is warm, there is plenty of moisture, and the soil is rich. No part of the island is far from the sea, and the plant seems to require such locations among other conditions. The amount of land suitable for sugar is several times as great as that which is now under cultivation. During the Spanish régime, the output rarely exceeded 1,000,000 tons a year, but in the settled times, after the liberation, the industry expanded rapidly. In 1912-1913, production amounted to 2,400,000 long tons; it rose to the highest point in 1924-1925, when the output amounted to over 5,000,000 long tons.

The decline of price from an annual average of 4 cents a pound in 1923-1924 to a little more than 2 cents a pound in 1925-1926 brought great hardship to planters. This situation led to a demand for legislation for relief. The Cuban Congress met the situation in May, 1926, by the enactment of the crop-limitation law. The breaking of new land for cane was prohibited, and the President was given authority to fix the date when cutting was to begin for the season 1926-1927, and to make provisions for the limitation of the crop during the two succeeding seasons. Whether legislation of this kind will prove beneficial remains to be seen; but since sugar is produced in so many places in the world, an advance in price due to the restrictions in Cuba is apt to be more largely of benefit to her competitors than to herself.

In many respects growing conditions in Mexico are similar to those in Cuba and it is possible for this country to greatly expand production. But at present production is not much in excess of consumption. Hitherto, sugar lands have remained largely in the hands of a few old families who lack the means to develop the property on a modern basis, and political unrest has discouraged the investment of foreign capital. But, as one authority contends, Mexico "might rank with Cuba if as much attention were given to the crop in one country as in the other."[1] Production in 1926-1927 was only 184,000 tons, or about one-twenty-fifth that of Cuba. Political troubles, heavy taxation, and low prices were among the causes which prevented progress.

Considerable quantities of sugar are produced in at least nine other Latin American countries. In some cases, home production covers domestic needs, and in others, there is a surplus for export. Production could be expanded greatly in most of these regions, and the introduction of modern methods would add further to crop prospects. Peru, which is usually a large exporter, is far below potential capacity. Shipments in 1926 were 727,000,000 pounds. The Chicama Valley is especially productive. "The returns have nowhere been surpassed; the production to the acre is double that of Cuba, where the average is 23-24 tons [of cane], in Peru 45-50 tons."[2] Argentine which produces from 350,000 to 400,000 tons a year is about self-sustaining. In Tucumán, the leading sugar province, cultivation could be extended fourfold by the further extension of systems of irrigation. Brazil has much undeveloped sugar land, and Venezuela, Colombia, and the Guianas are capable of much larger crops than they have ever harvested. All in all, the Americas have large amounts of available sugar land. In a few cases, as in Peru, foreign capital has already begun to seek the industry, but in view of the unfavorable market outlook there is little likelihood of further investment in any locality in the immediate future.

Hawaii has been for years an important producer of sugar. Fine rich soil, and climate splendidly adapted to the plant, have given the islands unusual advantages. But there are some disadvantages. Notwithstanding the fact that there are many rich districts, the land area, due to the small size of the islands, is limited. Some regions must be irrigated and others fertilized to fit them for farming. And irrigation is expensive for the reason that water supply must be pumped from artesian wells and distributed through canals or other channels. The Planters' Association employs a staff of experts in chemistry, entomology, and scientific agriculture, with the result that the returns per acre are the highest in the world. The average annual yield is about 4½ tons, but on irrigated land it reaches 6 tons. Sugar production is as highly organized in the islands as in any place in the world. An important feature of Hawaiian agriculture is that farms are large, the average in 1910 being nearly 600 acres.

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[1] *Mexico* (compiled by the Pan-American Union), p. 104.

[2] Annie S. Peck, *Industrial and Commercial South America*, p. 185.

Hawaii has greatly benefited by her close relations with the United States. The Reciprocity Treaty of 1876 admitted raw sugar and molasses free of duty, in return for free admission to the islands of a number of commodities from this country. After annexation in 1898, planters were assured the freedom of American markets, with the result that the sugar industry was encouraged to expand. Production which reached about 200,000 tons just before annexation was 787,000 tons in 1926. Practically all of this commodity is brought to the United States. The Hawaiian Islands have about reached their capacity.

Porto Rico, also, has gained by closer relations with the United States. The acquisition of the island not only afforded it a favored position in our market, but gave it the benefit of American enterprise. By a law of 1901 the products of the island were permitted entrance into the United States free of duty. Shortly, factory methods were changed, new mills were erected, and plantings were widely extended. During the years from 1850 to 1902 annual production of sugar ranged from about 25,000 to 75,000 tons. Shipments in 1912 were 325,000 tons and in 1926 over 500,000 tons. At present, most of the land suitable for sugar is under cultivation, and any future increase will depend largely on improvement of methods.

Unlike Hawaii and Porto Rico, there are large undeveloped areas in the Philippine Islands. Production has expanded rapidly since the United States assumed control. From about 100,000 tons in 1900 the output has grown to about 600,000 tons in 1926.

India and Java are among the largest producers in the world, and considerable quantities are produced in Formosa, in various parts of Africa, and in Australia. The world production in the year 1926-1927 is shown in the table given the next page.

World Production of Raw Cane Sugar, 1926-1927

Country	*Short Tons*
Cuba	5,040,000
India	3,593,000
Java	2,193,000
Hawaii	800,000
Brazil	784,000
Africa (various places)	678,000
Porto Rico	616,000
Philippine Islands	600,000
Oceania	560,000
Argentine	524,000
Formosa	465,000
Australia	465,000
Dominican Republic	395,000
Peru	308,000
United States	68,000
Total	17,089,000

It is evident from this table that the production is widely enough distributed to meet the commercial needs of the world. The production in Australia is largely from Queensland where great opportunities exist for the further extension of the industry. Shortage of labor is one of the great handicaps in this area.

> Many sincere friends of Australia counsel her to employ coloured labour on her tropical lands, which they refer to now as a "wasted heritage." India, they say, is overpopulated, and this surplus population could very profitably be employed on the sugar plantations of Queensland. By this means not only would the population difficulty of India be solved, but enormous supplies of sugar and other tropical produce would be added to the wealth of the empire. . . . The first plantations in Queensland were worked by coloured laborers, Kanakas, brought in from the Pacific Islands, mainly from the New Hebrides; but in 1901 the Commonwealth Parliament passed a law saying that these men were to be sent back to their homes, and from that time forward the sugar produced in Queensland has been produced almost entirely by the labour of the white man. The idea is, instead of enormous plantations worked by gangs of unskilled, poorly-paid coloured labourers, to have small estates worked by their owners and a few highly-skilled well-paid assistants.[3]

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[3] J. C. Cunningham, *Products of the Empire,* p. 89.

Of course, here, two ideals clash, the one, the creation of large amounts of wealth by the organization of a labor force which is suited for the work, and the other, the wide diffusion of ownership among those who work themselves, with a few assistants, on small estates. The question of economic economies has apparently dropped into the background.

Although British India is the second largest producer of sugar in the world, it has no surplus for export. In fact, India usually imports sugar from Java and Mauritius. Such imports in 1925-1926 amounted to more than 900,000 tons. The Netherlands East Indies, including Java, rank next to Cuba in the export trade. A very large percentage of this surplus is shipped to India, Japan, and China. Although the land upon which sugar can be grown in Java is relatively limited—the area is about 49,000 square miles—the island has the usual climatic and soil advantages, and in addition, a great abundance of cheap labor. In fact, the enormous population, numbering about 33,000,000, is in some respects a disadvantage for sugar growing, because the people must be fed largely from local products, many of which are competing crops with respect to sugar. The large production is partly a result of the encouragements given by the Dutch government to the introduction of scientific methods not only in the cultivation of the crop, but in methods of refining. The "Java white," an incompletely refined sugar, is particularly adapted to the Indian market, where religious scruples prevent the use of a product which has been clarified with animal charcoal.

BEET SUGAR

We have seen on a former page that the rise of the beet-sugar industry is a matter of recent history. Introduced originally in Europe, about 1800, as a means of supply when the trade in cane sugar was curtailed by war, the industry has been developed largely under the influence of protective tariffs and both direct and indirect bounties on exports. The bounty system was not altogether satisfactory even to those who employed it. The cost was considerable, and the policy sometimes involved the bounty-giving country in international trade difficulties. The

United Kingdom was opposed to the policy because it diminished the market for sugar produced in British dominions. Moreover, in some countries there was a strong popular disapproval of protection, because sugar was an article of general consumption, and it was asserted that the tariff was a burden on the poorer classes of consumers.

Beet sugar is a serious competitor of the cane product not only in a number of domestic markets, as in the United States, but in international trade. The production of beets is not as rigidly limited by climatic conditions as is the case with cane, and the industry can exist in any country which has a developed agriculture. Countries such as Germany, France, Russia, and Czechoslovakia, which are large producers of beet sugar, diminish by that much the demand for the cane product. Some of these problems have been the subject of international conference.

The stated purpose of the Brussels International Sugar Convention, in force September 1, 1903, was "to equalize the conditions of competition between beet sugar and cane sugar in the various countries, (and) to further the development of the consumption of sugar."[4] Among other things, the conference recommended the abolition of the direct and indirect bounties on production and exportation of sugar, and the limitation of the rate of import duty. In recent years, because of the great excess of all kinds of sugar-producing capacity, the tables have been turned, and instead of promoting production, a number of countries now look with favor on international agreements to curtail production. Such proposals for curtailment were made in 1927 by representatives of Cuba, Germany, Czechoslovakia, and Poland.

Some twelve countries are important producers of beet sugar. Named in the order of decreasing volume, the largest production is in Germany, Czechoslovakia, the United States, and Russia. None of these countries produce cane, with the exception of a relatively small amount in the United States. The world production of beet sugar is shown in the appended table.

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[4] *The Cane Sugar Industry,* Miscellaneous Series Bulletin No. 53 (U. S. Department of War), p. 19.

World Production of Beet Sugar (in Terms of Raw), 1926-1927

Country	*Short Tons*
Germany	1,794,000
Czechoslovakia	1,132,000
United States	1,044,000
Russia	904,000
France	758,000
Poland	655,000
Italy	352,000
Netherlands	305,000
Spain	276,000
Belgium	255,000
Hungary	200,000
Sweden	23,000
All others	737,000
Total	8,435,000

Where the development of the beet-sugar industry has been accomplished by conscious national policy, the reasons have been to render the country more or less independent of the imported product, and to encourage agriculture by adding an important new industry. Occasionally, where the residue from the industry could be used as food for livestock, this added purpose has inspired national promotion. The production of beet sugar is essentially a European enterprise, less than 15 per cent of the total being produced in other regions.

The development of the beet-sugar industry in the United States dates from about 1890. The average annual production during the five years ending with that year was only 1,000 short tons. It rose to the highest production in 1921 with an output of 1,089,000 tons. Since that date both beet and cane have been depressed by low prices.

THE SUGAR TRADE

Per capita consumption is no indication of the amount of sugar used in the homes, since large quantities are consumed in a number of manufacturing enterprises, including the production of candies and bakery products. In 1913-1914 per capita consumption in the United Kingdom was 93.37 pounds, in the

United States 89.14 pounds, in Germany 45.13 pounds, and in France 43.85 pounds. But whatever the purpose of consumption, the per capita rate has been increasing steadily during the last twenty-five years.

In 1925, about 12,500,000 tons of sugar moved in international trade. By far the largest percentage was exported from the country of original production to other countries for final consumption, but a portion of the sugar trade was made up of reëxport business. Cuba was the largest single source of export sugar, with shipments amounting to 5,500,000 tons, and the Netherlands East Indies ranked next, with an export of 2,270,000 tons. Czechoslovakia, Germany, and the Philippine Islands also shipped large amounts, the two countries first named being the only important exporters of beet sugar.

The United States is the largest world importer. Shipments in 1926 came chiefly from Cuba, Hawaii, Porto Rico, and the Philippine Islands, amounting to nearly 12 billion pounds. The table given below indicates the distribution of these receipts in 1926.

IMPORTS OF SUGAR INTO THE UNITED STATES FROM CERTAIN SOURCES, 1926

Source of Import	*Pounds*
Cuba	8,399,417,000
Hawaii	1,475,014,000
Porto Rico	1,118,497,000
Philippine Islands	752,000,000
TOTAL	11,744,928,000

This material was imported chiefly as unrefined sugar, and was manufactured in domestic refineries into customary forms—granulated, loaf, and powdered product. Britain, alone, of the leading European countries does not produce beet sugar, and having no domestic supplies of cane, the total domestic requirement must be imported. The total imports into the United Kingdom in 1925 were 2,300,000 short tons. This supply is obtained from a dozen or more sources. Within the Empire, the West Indies, British Guiana, and Mauritius are the principal shippers; the United States and Cuba also contribute to the

British supply, and in South America, Peru and Argentine, principally the former, make shipments to the English markets. British India usually ranks third as an importer. Receipts in 1925 amounted to about 841,000 tons. The supply is obtained chiefly from Far Eastern sources, with Java contributing the larger proportion.

THE MANUFACTURE OF SUGAR

Most of the sugar which arrives in this country from the primary sources comes in the form of the unrefined product. The preliminary processes in preparing sugar for the market are performed on or near the plantations. The cane is crushed between heavy rollers to extract the juice; this liquid is then clarified, and sterilized by heating to about 130 degrees; lime is then added to neutralize the acids; the juice is boiled down to the point of crystallization, and then placed in centrifugal separators to remove the crystals of sugar; this substance is crude or brown sugar, which is sent to the refiner. The main steps in the final preparation are to dissolve the crude product in water, filter with charcoal, and evaporate the liquid in vacuum pans. The white crystals are then manufactured into the various commercial forms. Molasses, which is a kind of by-product obtained in separating the brown sugar from the liquid mass, is also an article of commerce.

The methods for the production of sugar from beets are not essentially different from the manufacture of cane sugar. The first step is to obtain the juice, and this is done by either slicing the beets and heating with water, or by rasping the beet and then pressing. The liquid is separated from the impurities. The subsequent steps are like those in the manufacture of cane sugar.

QUESTIONS

1. How do you account for the rise of beet sugar when there are still large areas in the world from which cane can be produced?
2. Trace the rise of cane sugar as an article of commerce.
3. Is sugar a necessity? Was it a necessity some 500 years ago? Why?

4. Do inventions and discoveries often revolutionize the trade in raw materials? Give examples.

5. Is there any article on the market, the use of which may not be affected by a new invention? Why?

6. Do you think that it is possible to stabilize any particular business? Business in general? Why?

7. How has Cuba tried to handle the problem of overproduction of cane sugar? With what success? Why? Can you suggest a solution for the overproduction of Cuban cane sugar?

8. Do you think that restrictions on the production of sugar in Cuba more largely benefits growers in competing regions than in Cuba? Why?

9. What parts of the world are the chief producers of cane sugar?

10. Explain the labor situation in Australia. How has this affected the production of sugar?

11. Explain how the following conditions in various parts of the world have affected the sugar industry: labor conditions; lack of capital for investment in the industry; stable political conditions; regulation of the crop; the presence of competing crops; bounties for the production of beet sugar; tariffs on the import of sugar into certain countries; inventions in the production of sugar.

12. What parts of the world are the chief producers of beet sugar?

13. The Brussels International Sugar Convention proposed to "equalize the conditions of competition between beet sugar and cane sugar in the various countries." Do you think that this can be done? Why?

14. Why do not the various European countries import cane sugar instead of fostering the local production of beet sugar?

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CHAPTER XIX

THE INDUSTRIAL FIBERS

In the struggle upward from barbarism the human race has made use of many kinds of materials for clothing; if necessary, we could fall back on some of the more primitive sources, but there is no reason for apprehension about a shortage of any of the fibers in present use for they can be produced in enormous quantities. In fact, our present supply would be greatly in excess of needs if we were not so lavish in our consumption. We are as wasteful of fabrics as of food products—a condition which is largely forced upon us by the demands of fad and fashion, if not of folly. In our thought about future supplies we must take into account the ingenuity of the inventors who are constantly in quest of substitutes. Wood pulp and the pith of the corn stalk even now hold out a promise of enormous supplies of substitute material, and no one can guess what another decade of invention will produce.

LEADING INDUSTRIAL FIBERS

One most interesting feature in the development of a progressive people is the incessant shifting from one material to another. Iron and steel have long since replaced stone and bronze, and in the world of fabrics, cotton, wool, and silk have largely taken the place of the skins of animals and of apparel made from reeds and grasses. Invention works great changes not only in the character of the finished products, but in the kinds of raw materials which shall be demanded for manufacture into finished goods. The great new textile invention of the latter part of the eighteenth century caused a shift in the weight of demand from wool to cotton, and within the last twenty years, we have seen some of the burden taken from both silk and wool by the use of wood pulp and other materials. Cotton ranks first today as a textile material, but this statement contains no prophecy as to the future, for a great new invention may shift the demand to some substance which at present may have no significance for textile purposes.

The ranking materials for present textile purposes are cotton, wool, silk, flax—the source of linen and linseed oil—and if we include the baser textiles, we should add as important materials jute, hemp, and sisal. But this list is by no means complete, because industry makes use of many other fibrous materials. Our remarks in a former chapter relative to the diversification of use, and the exacting demands for industrial materials apply with equal weight to the industrial fibers. Each must suit the more or less specialized demand which is made upon it. Thus, we should include some of the minor fibers.

Mexico supplies a considerable number of such materials. Henequen, or sisal grass, is one of the most important. It grows not only in Yucatan, but in some parts of Central America, and to a limited extent in some of the West Indies. The fiber is one of the most important materials for the manufacture of rope, cordage, and cables. The Aztecs made extensive use of the plant as a food, while the leaves were used for thatching, the fiber was a textile material, and from the juice was manufactured a drink called octli, or as it is known today, pulque. The plant requires very little attention; it thrives in arid, stony regions, where most other plants cannot survive; it may be harvested at almost any season; and after it reaches maturity—in about five years—it continues to yield for fifteen or twenty years. Ixtle, or Tampico fiber, is another important product of Mexico. Zapupe, another product of this country, has interesting possibilities. "It produces a fine white fibre, strong, brilliant, soft, and pliable in texture, and is said to be far superior in quality to other similar Mexican plants."[1] The fiber is manufactured into rope and cordage. When divided by machinery into a hundred or more parts, or threads, it is used as a substitute for silk. Pita, which has marked characteristics as compared with sisal and zapupe, is manufactured into seines, nets, matting, lariats, and hammocks, to name only a few commodities into which it enters. The plant grows wild in the state of Vera Cruz. Zacatón, or broomroot, is a Mexican product exported chiefly to France and Germany.

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[1] *Mexico* (compiled by the Pan-American Union), p. 107.

The pineapple and the coconut palm produce useful fibers; coir, a product of the latter, is produced by soaking the husks in water until soft enough to work; and then by separating and drying the fiber. The mass contains several qualities of material; the straightest fibers are manufactured into rope, coarse thread, and into cocoa matting, while the stiffer material is used in making brushes. The coconut palm is not only a source of raw material for the commodities just named, but of copra, which is the dried kernel of the coconut—an important source of oil— and the timber is sometimes used for cabinet work and as structural material. Pineapple fiber is often of local importance in the production of rope, cordage, and fabrics; occasionally, native workers develop considerable skill in these industries.

Madagascar supplies considerable quantities of raphia, a product of a kind of palm; it is often used by natives in making coarse cloth, but as a material of commerce it is consumed in the manufacture of mats, basketry, and various kinds of ornamental work. Java is one of the chief sources of kapok or silk cotton. In 1925 the United States imported about 8,000 tons of this material along with about 12,000 tons of agave fibres. Ecuador was the original home of the Panama hat; but the industry has now spread to other countries, including Colombia and Venezuela. The workers use as their raw material the fiber obtained from the leaf of a palm *(Carludovica palmata)*. The fiber is carefully separated from the tender leaf and bleached either in the sun or in a weak solution of lemon juice, and then worked up slowly into the Panama hat.

Industry makes use of certain quantities of Spanish moss in the manufacture of upholstery, of bamboo split into fine strips for basketry and brushes, of ramie or China grass for cordage, and in some European countries for the production of fabrics; and this says nothing of the consumption of the straws of rye, wheat, barley, broom corn, rice, and esparto in the production of a considerable variety of goods, such as hats, rope, matting, brooms, upholstery, etc. No fibre is too common for use in the trade. Practically every substance of this kind has a potential use if it can serve some specialized purpose. With the progress of industry, attention is continually directed to new products, and new industries arise to prepare them for the market.

COTTON

The fiber is one of the most important, if not the most important, material that moves in international commerce. If we included in this estimate the fabrics manufactured from the raw material there would be no question as to the rank. During the last five or six years the export of raw cotton from the United States has amounted to over $600,000,000 a year, and on one occasion, in 1925, it was over a billion dollars. Before 1860, cotton frequently constituted more than half the total value of the exports from this country. Of Great Britain it has been said: "There is no industry in Great Britain, except agriculture, which affords so much employment, directly or indirectly, for the masses of the people, as the manipulation of cotton, or which is of more importance to the whole mercantile or industrial system of England."[2] In the case of the United Kingdom, the foreign trade in cotton manufactures is often of more relative importance than raw cotton in the foreign trade of the United States. In fact, the exports of such materials from the United Kingdom in 1926 amounted to more than $1,300,000,000. While the rank as an export is not as high in Germany and France, the cottons nevertheless, are an important branch of their foreign trade.

A great organization has been built up in many parts of the world to grow, to buy and sell the raw material, to transport it to the manufacturing centers, and to finance the whole process from beginning to end, and to convey from the manufacturing centers a vast volume of manufactured goods to merchants in practically every part of the world. And this much cannot be said of any other commodity that passes into oversea trade.

In our estimate of cotton we should also include the service to the consumer. This cheap and abundant material has made possible a wide diffusion of consumption with all that this signifies for comfort, convenience, and welfare. It serves this purpose more thoroughly than wool or silk. In addition, cotton growing and manufacture are the basis for the livelihood of millions of people in all parts of the world, and in trade it is one of the most important sources of profit of all world commodities.

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[2] Peake, *Common Commodities of Commerce,* quoted from Cunningham, *op. cit.,* p. 168.

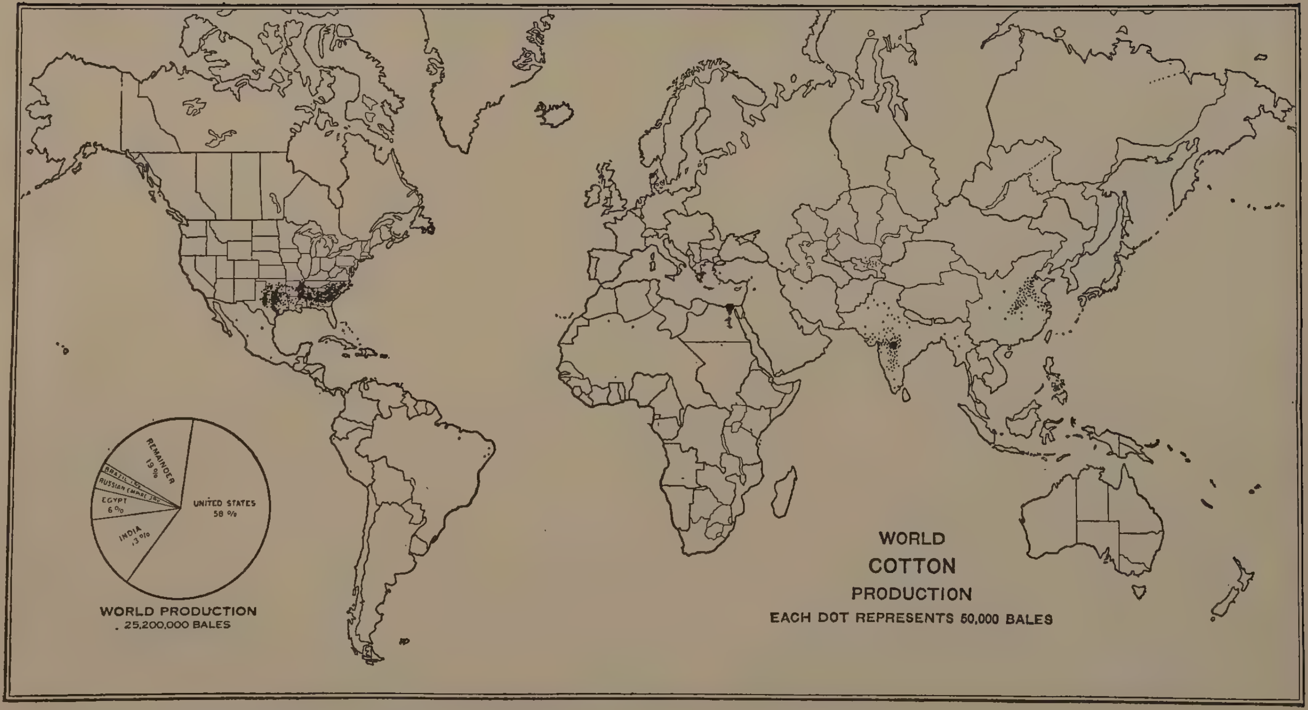
That cotton ranks among the most valuable of the natural products is beyond question. As with many other great materials, the early history is obscure. It may have found application first in India; at any rate, it was cultivated in that part of the world in the fifth century B.C., and the people have developed a system of spinning, weaving, and dyeing. One of the most remarkable features of the Indian industry is that after this much had been accomplished progress came to an end, and there were no new methods employed until recent years when modern spinning and weaving machinery was taken to India from England. Cotton was grown in Egypt from remote times, but in the arts of manufacture, these people, also, progressed to a certain point and then stopped. Production of both cotton and cotton fabrics was carried on in Mexico, and in the west coast regions of South America, at the time of the earliest Spanish explorations and there are evidences that the industry in the new world was many hundreds of years old.

Prior to the Industrial Revolution wool and flax were the chief textile raw materials. The cotton plant had been grown to some extent in the United States, but in a small way to supply household producers. Manufacturers on this continent had imported small quantities of cotton from the Dutch settlements in Surinam, from Jamaica, and from other parts of the West Indies; but the manufacture of fabrics was of little or no importance. In England, as late as 1760, the manufacture of cottons was rated as "amongst the humbles of domestic arts." Not that producers failed to realize the importance of the fiber, but that the great labor in separating cotton from seed stood in the way of extensive use. This was particularly the case with the upland variety which adhered closely to the seed. The roller gin, which had been used for some time with the sea-island cotton could not be used with the short staple. In this case, it was necessary to separate cotton from seed by hand.

This difficulty was met with the invention of the cotton gin by Eli Whitney in 1793. The basic idea of the gin was the use of a number of circular saws which pulled the lint from the seed. Whitney's device was a crude affair compared with the gins of today, but it performed a remarkable amount of work. Whitney himself explained how the device manifolded work in the following words: "This machine may be turned by water or with a horse, with the greatest ease, and one man and a horse will do more than fifty men with the old machines. It makes the labor fifty times less, without throwing any class of people out of business."

As a matter of fact, it did the reverse of throwing people out of work, for it not only created many new industries which gave employment to men and women, but it made possible an enormous extension of the agricultural area of the United States. It gave a great incentive to the further invention of textile machinery, and it led to a new organization of the productive forces not only in England, the chief textile-manufacturing country, but in the United States. It made cotton the most important export commodity of this country, and because of this resource, it gave the country a large means of paying interest on funds borrowed abroad, and ultimately for the liquidation of the principle.

The effect of the gin on cotton growing in the United States was almost instantaneous. American production amounted to only 4,000 bales in 1790; it became 73,200 bales in 1800, 1,347,000 bales in 1840, and 3,840,000 bales in 1860. From this beginning, the United States has become the greatest producer and exporter of short-staple cotton in the world. The proportion varies somewhat from year to year, but it remains not far from 60 per cent. In 1926 it was a little more than 61 per cent. This signifies that with the exception of the cotton from Egypt, Peru, and a few other places, which is used for more or less specialized purposes, the United States not only supplies its own mills, but those of Europe and Japan. The capacity of this country for production greatly exceeds the output even in bumper years. Production in 1926 was 17,910,000 bales. Much of our cotton is grown under


WORLD
COTTON
PRODUCTION
EACH DOT REPRESENTS 50,000 BALES
REMAINDER 19%
BRAZIL 1%
RUSSIAN EMPIRE 3%
EGYPT 6%
INDIA 13%
UNITED STATES 58%
WORLD PRODUCTION
25,200,000 BALES

From Finch and Baker, Geography of the World's Agriculture

Production of cotton in the world

a poor system of organization, on small farms, often with inadequate knowledge about the maintenance of the soil and the protection of the crop. While cotton has the advantages of all the modern implements for preparing and cultivating the soil, there is as yet no effective device for harvesting the crop, although a number of inventions have been tried. The new sledding process holds out more hope than any of its predecessors. Moreover, from year to year, various pests destroy large amounts of cotton. With such enemies as the army worm, the cutworm, the blister mite, the bollworm, and the boll weevil the farmer has enough to contend with. Various remedies have been employed, such as burning the refuse, cleaning out fence corners, spraying the fields with a chemical poison, and the development of a plant that resists the weevil, and undoubtedly the pests will be conquered in time, but meanwhile they destroy a vast amount of cotton.

The total production of cotton in the world is 1925-1926 was estimated at 27,700,000 bales. The distribution of this amount among the producing countries is shown in the table below:

PRODUCTION OF COTTON IN SPECIFIED COUNTRIES, 1925-1926
(*bales of 478 pounds each*)

Country	*Bales*
United States	16,104,000
India	5,053,000
China (Commercial)	2,114,000
Egypt	1,629,000
Russia (Asiatic)	737,000
Brazil	602,000
Mexico	202,000
Peru	200,000
All others	1,059,000
TOTAL	27,700,000

Small quantities of cotton are grown in other places in the world, more largely for domestic consumption than for export. But some of these regions may become exporters. In 1926 Argentine had about 275,000 acres planted to cotton, chiefly in the northeastern and northwestern part of the country. The excess over domestic consumption is exported to Germany and the United Kingdom. Colombia and Venezuela grow small amounts for domestic use, and it is possible to greatly enlarge the crop. Production is still of considerable importance in St. Vincent, Barbados, Grenada, and other islands. The crop is on the increase in Nigeria. Cotton may be grown on a considerable scale in other parts of the world, where, as yet, production has scarcely begun, as in the Anglo-Egyptian Sudan, where the industry awaits the development of irrigation and transportation, and in portions of South Africa and Queensland. The crop area could be greatly expanded in Asiatic Russia.

Since 1901, possibly with some thought as to the future supply when American consumption will use a much larger proportion of domestic production than at present, and possibly for the purpose of adding to the self-sufficiency of the Empire, certain British organizations, such as the Cotton Growers' Association, have been encouraging the further increase in production in various parts of the Empire. This enterprise is meeting with some success. But it takes years of effort to develop extensive cultivation in new areas. Growing requires local capital for the planters, or foreign investments in plantations, training the farmer in methods of planting and protecting the crop, adequate transportation, and a well-developed commercial system to handle the product from field to mill. Moreover, where American seed has been used, much scientific study has been required to adapt it to the new conditions. But no one doubts that these many problems will be solved in time, and that some of the newer regions will become competitors of the United States.

These conditions throw interesting light on some proposed policies in this country. Under proper conditions it is possible to "break the American cotton monopoly." But what is required more than anything else is a price level high enough in foreign markets to encourage planters who are still in the experimental stage. At times, some American cotton-growing organizations have urged the limitation of acreage for the purpose of raising the price. A higher price in international markets would be a great assistance to farmers in other countries who are now struggling to put crops on a profitable basis. The results under the newer proposals contained in the McNary-Haugen bill which was disapproved by the President, are more elusive but, in the long run, just as detrimental to American cotton-growing interests. The first results would probably be indirect, operating on American manufacturers to diminish their ability to compete in domestic cotton. The most hopeful solution to the American cotton growers' problem is in the improvement of methods of production and distribution which will enable them to reduce costs and thus maintain sales both at home and abroad.

J. Horace McFarland Company

Picking cotton in Georgia

The quality of cotton varies greatly from place to place. It is not always of the same grade on adjoining plantations; but marked differences exist among the products of different parts of the world. American cotton is chiefly short staple of 1.2 or 1.3 inches or less. But Carolina and Georgia sea-island cotton has a staple of about 1.8 inches, and Barbados about 2 inches. Indian cotton is short staple,—from .8 to 1.0 inch, and the Chinese product is still shorter. Egyptian cotton averages from 1.2 to 1.5 inches.

The Egyptian product is fine and strong and is used in the manufacture of knit goods, sewing thread, fabric for automobile tires, and for mixing with other cotton. Cultivation under more modern conditions began in Egypt about 1820. The cutting off of the American supply during the Civil War gave the industry its first real incentive to growth. While the area in which the crop can be grown is limited, conditions are suited for the success of the industry, although much of the crop must be irrigated. Practically all cotton-manufacturing countries use some Egyptian products, but as a rule, Great Britain takes about half the supply.

Cotton grows in the natural state in some places in Peru, but this country has developed its own variety *(Gossypium peruvianum)*, which is "so soft and fine that it is called vegetable wool; it is much used for weaving underwear, stockings, etc., with wool, which it even improves, as the cloth is less liable to shrinkage. . . . [The plant] holds out well through drought, requiring but one irrigation yearly."[3] The staple is from 1 1/16 to 1⅛ inches long, and of Tanguis, a new variety brought into existence to resist a parasite that attacks the roots of the ordinary domestic variety, the staple is about 1½ inches.

The value of cotton as a commercial crop is greatly enhanced by the fact that it can be grown in many parts of the world in large quantities under an organized system of agriculture. It requires plenty of moisture during the early growing season, but dry weather, with little or no rain is needed when the seeds are ripening. The peculiar shape of the cotton fiber gives it a great advantage over other vegetable materials for the purpose of the spinner. It is a twisted flattened cylinder. Due to the twist, the fibers readily "kink" together and thereby make possible a strong and durable thread.

The yield varies greatly from region to region, depending on natural conditions, and upon the skill in cultivation. In the crop year 1926-1927, the yield of lint in the United States was 187 pounds per acre, in Egypt 386 pounds per acre, in Peru 337 pounds, in Russia (Asiatic) 218 pounds, and in India 79 pounds. The low yield and poor quality of Indian cotton is largely due to careless methods of cultivation. In the central and southern portions of the country the seed is planted in lines, and the planter makes some effort at careful farming, but in nothern India the seed is broadcast, often mixed with other crops, and little or no attention is given to it from time of sowing to harvest. With greater care India could greatly increase her output. As a rule, the lint is too short and coarse for use in English mills, but Japan, Germany, Belgium, and Italy usually take the product of the Indian growers.

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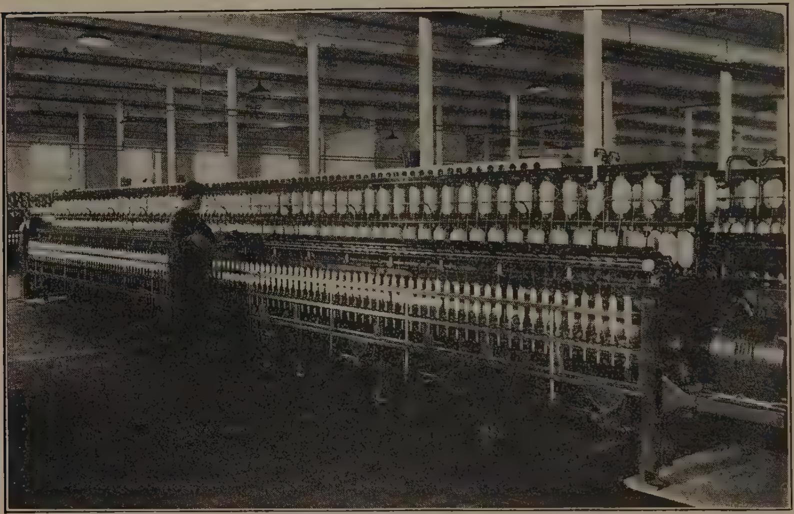
[3] Annie S. Peck, *Industrial and Commercial South America*, p. 186.

In China conditions are about as unsatisfactory as in India. While the plant is grown in a number of parts of the country, the smallness of the farms—averaging probably not more than two acres—makes improvement extremely difficult. The country is hampered, also, by lack of transportation, by high taxes, and by lack of means for the diffusion of information about better methods. Much of the cotton is consumed in regions of growth by small household manufacturers. The Chinese have had great difficulty in adjusting American cotton to growing conditions in their country.

IMPORTS OF COTTON INTO CERTAIN COUNTRIES, 1926

Country	*Bales*
United Kingdom	3,338,000
Japan	3,213,000
France	1,606,000
Germany	1,435,000
Italy	1,035,000
Czechoslovakia	581,000
Spain	418,000
Belgium	395,000
United States	338,000
Canada	274,000
All others	1,030,000
TOTAL	13,663,000

As we have already seen, the United States is the chief exporter of the cotton. Our export added to that of Egypt and India usually amounts to about 90 per cent of the cotton which moves in international trade. In 1926 India exported about 3,200,000 bales, Egypt about 1,400,000 bales, and the United States about 8,100,000. Since much of the Indian product is shipped to Japan, the burden of supplying Europe with short-staple cotton falls largely on the United States. The imports of cotton from all sources into the leading countries are shown in the table on page 387.



B. B. & R. Knight

Modern cotton spinning

Important changes are in process which in time may affect the relative position of the manufacturing countries. The United Kingdom ranks first as an exporter of cotton materials. But other countries are making efforts to stimulate production and export. India and Japan may become much greater factors than at present in the supply of the Far Eastern markets, and some of the South American countries may become much more self-sustaining. Moreover, some of the newer countries of Europe are encouraging the development of the manufacture of cotton. From

1913 to 1926 the number of spindles in Asia increased from about 8,000 to 17,000, and while the total is small in comparison with the world total it indicates a tendency. The number of spindles in Great Britain increased only about 2,000 during this period, and in all of Europe about 3,000. The total number of spindles in the world in 1926 was 163,000,000, of which 57,000,000 were in Great Britain and 37,000,000 in the United States.

Although the trade in the manufacture of cottons has been depressed in the United States, as in all other nations, this country has a great advantage in its enormous domestic market. Our export trade is very small in proportion to our total manufacture of cottons; to give the actual figures: in 1925, exports were valued at $124,000,000, while the total value of cotton goods manufactured in this country was $2,627,900,000. But conditions, particularly in the United Kingdom are different, because exports are a large part of the factory output, and consequently the industry depends on foreign trade for its prosperity.

In Europe, high tariffs, shifting labor costs, and the loss of some foreign markets are among the troubles. The situation with reference to Great Britain has been described as follows:

> The decline in trade is most serious for Great Britain: In the last four years, however, the variations have been slight. The question with which Lancashire is now struggling is how to adjust an industry with heavy capital charges to a smaller production and at the same time maintain an export trade which depends on being able to compete in the world markets with newer industries employing cheaper labor in Eastern countries. The competition is mainly with the industries within the importing market itself.[4]

WOOL

In our discussion of the livestock industry we have suggested the chief countries which are exporters of wool. Sheep are grown in practically every country, but in many instances the supply of wool does not suffice for domestic uses. In 1925 about 60 per cent of the world's wool production was shipped in the foreign trade, and the greater part of this supply was exported by Australia, Argentine, the Union of South Africa, New Zealand, and

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[4] *Europa,* 1928, p. 78.

Uruguay, and more than one-third of this total was shipped from Australia. This country possesses an almost unlimited area upon which sheep may graze, but one great difficulty is water supply. This has been met to some extent by the construction of certain great projects, but much more work remains to be done. In the great drought of 1884 it was said that more the 10,000,000 sheep died of thirst. The method now employed of supplying water is either by artesian wells, or by the storage of surface water. One of the most important of these works is at Burrinjuck, near the junction of the Murrumbidgee and the Goodrabijbee rivers. This will supply water to about a million acres of pasture land. New South Wales is the chief wool producer in Australia. "In times of drought the difficulty is not so much to obtain food as to find water for the flocks. . . . Except in the valleys of the rivers, these great plains are treeless, but over all this vast expanse there grow in abundance many kinds of succulent grasses, which nourish millions and millions of merino sheep. In dry seasons, when all these grasses are burnt up, and the land looks as dry and parched as a wilderness, the salt-brush still survives, and affords sustenance to the animals." [5]

Conditions in Queensland are similar to those in New South Wales, and the water problem is of the same nature. Sheep are raised in other parts of Australia, but the regions just named are the most important. New Zealand has abundant pasture lands, although the time is probably not far distant when much of the area which is now devoted to sheep will be sown to wheat and other crops. Conditions, however, are very favorable for the present development of the sheep industry. In recent years, the annual exports of wool have amounted to about 200,000,000 pounds. Shipments from the Union of South Africa are about equal to those of New Zealand. Grazing lands are scattered through various parts of the Union, and conditions are generally favorable for the development of the industry, except perhaps, in portions of the Transvaal and in the Bush Veld which are subject to ravages of the tsetse fly. We have seen in connection with our discussion of the livestock industry that some regions in South America are far below their possible capacity for the production of sheep; on the other hand the United States, at least temporarily, seems to have reached its capacity. Although these animals are raised in every state in America about 40 per cent of the total number is in the Mountain States. But the industry seems to be declining. The number has declined from a maximum of 61,000,000 animals in 1900 to about 41,000,000 in 1927. The number has fluctuated from year to year, but the tendency has been towards smaller production—a condition which is brought about by the increasing cost of maintaining the animals, by the gradual expansion of other types of farming, and by the uncertainties of the wool market. The total world production of wool in 1926 was 3,061,000,000 pounds. Of this, South America, chiefly Argentine and Uruguay, supplied 508,000,000 pounds; Europe 767,000,000, with the United Kingdom as the largest single producer; and Australia and New Zealand together produced 976,000,000 pounds. The exports from the principal countries are shown below.

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[5] J. C. Cunningham, *Products of the Empire*, p. 180.

Exports of Wool from the Principal Countries, 1925

Country	*Pounds*
Australia	673,174,000
Argentine	249,777,000
Union of South Africa	220,176,000
New Zealand	205,727,000
Uruguay	89,442,000

Industry makes use of the wool or hair of a considerable number of other animals. Not the least interesting of these is the angora goat, which is said to be a distinctively Turkish animal. The hair is a product of what is known locally as the "tiftik" goat, to distinguish it from the common animal. Some 15,000,000 of these goats were in Turkey in 1914, but the number has been reduced to half, due to the ravages of the War. The hair is a "most valuable product, owing to new processes abroad of utilizing the fleece in dress goods and imitation furs, besides its increased employment for yarns and braids, for plush in railway carriages, for linings in motor cars, for rugs, bookbindings, shoes and gloves."[6] This product, as often prepared for the market is known as mohair. Another member of the goat family from Tibet supplies a soft woolly hair which was woven into the cashmere shawl, an article which was once in great demand. Peru supplies the wool of the llama, the vicuña, and the alpaca. The hair of the latter is the most important, but that of the llama and vicuña is used by the natives in making fabrics.

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[6] *Turkey,* Trade Promotion Series No. 28, p. 108.

Human hair and the hair and manes of horses are articles of commerce, as is shown by the fact that nearly 3,100,000 pounds of the former and 4,600,000 pounds of the latter were imported into the United States in 1926. China is the chief source of human hair. Here, the spread of modern ideas, and the growth of democracy has weakened the former respect for the Manchu régime, and is bringing about the abandonment of the queue, the ancient emblem of loyalty. World commerce seems to be the chief beneficiary. The trade in hair is about equally divided among Japan, Hongkong and the United States. Much of this product is exported abroad, where it is bleached and softened and returned to China for manufacture into nets. The recent fashion of bobbing the hair has deprived the industry engaged in the manufacture of nets of some of its prosperity.

SILK

China is the original home of the silk industry. The beginnings of the culture of the silkworm and the manufacture of the fabric are interwoven with the legends of the country, which indicates that the industry is of great antiquity. The Empress Se-ling-She, wife of Hwang-ti (2640 B.C.), one of the greatest of China's rulers, is said to have taken a personal interest not only in the care of the silkworm, but in the arts of spinning and weaving, and she is credited with having invented a loom upon which the threads could be easily woven. For centuries the Chinese regarded the art of silk making as a national secret, which every Chinese was bound to respect. Knowledge of the silkworm reached Japan through Korea in about the third century.

Silk was one of the most prized articles in ancient Rome—actually worth its weight in gold. Fabrics were imported from China over channels which even the European merchants did not know. Sericulture in southern Europe did not begin until the sixth century. About this time, two Persian monks, who had resided in China, brought the eggs of the silkworm concealed in a hollow cane. This clandestine business laid the foundation of European sericulture. If the worms of the sixth century were as prolific as those of today, this little importation of less than an ounce of eggs probably yielded more than 30,000 young silkworms which soon began to multiply with incredible rapidity, and thus laid the basis for an industry which rendered Europe largely independent of China, and which, in the course of years, was to become a source of income for millions of people, and to provide for the enrichment of thousands of merchants and manufacturers. In all these ways, the economic and social results of the development of the silk industry are not unlike those relating to cotton. Silk was once a badge of distinction and a symbol of royalty, but modern processes of production have brought the fabric within the means of vast numbers of consumers. Not only this, but the recent introduction of artificial silk, which in some respects is better than the real product, is still further spreading the silk market among the masses.

The silk industry is still an important branch of enterprise in its native home, but Japan has now become the greatest producer in the world, and the Mediterranean countries produce just about as much silk as China. One reason why this country has not pressed its original advantages is that the Chinese, as a rule, still cling to traditional methods of cultivation. For some years, the ravages of the silkworm diseases hampered the progress of the industry, although this evil is now being gradually overcome. But the inefficiencies in selecting the mulberry, upon which the worm feeds, and carelessness in selection and breeding of the worms, and marketing the cocoons are still drawbacks on Chinese enterprises. Lack of means of transportation within the country, also, involves a great waste in the processes of marketing.

The industry is capable of enormous expansion, particularly in China, where there is a great abundance of cheap labor, but since, in recent years, the silk market has become both competitive and selective, success depends as much upon the quality of the product as on its quantity. Buyers prefer the silk which not only meets their tests of quality, but which has been carefully prepared for the purposes of trade. In both these respects, Chinese industry has been notably lacking.

Silk of varying quality is produced from a number of so-called silkworms. Three classes of raw silk are produced in China, namely, white, the product chiefly of Kiangsu, Chekiang, and the Canton district; the yellow, which is obtained chiefly from the Szechwan and Shantung provinces; and the wild or tussah silk, which is produced mainly in Manchuria, Shantung and Chili.

Pongee, or Shantung silk, is the product of a worm called the wild cocoon, which feeds on oak leaves. The fiber is of greater strength than the ordinary mulberry silk, but the luster and color are not as acceptable to many consumers. Thus, it is used for more or less specialized purposes. The manufacture of pongee is chiefly a local industry, pursued in the regions where the cocoons are produced. In most places weaving is still a primitive process. In China, the local weaver uses a crude handmade loom equipped with bamboo teeth. Tussah silk is produced in portions of India and Burma, and the Eri silkworm, which feeds on the leaves of the castor plant, produces a peculiar kind of silk, which is not reeled in the ordinary way, but spun after the fashion of many ordinary fibers.

The world production of silk could be enormously expanded, given the proper economic conditions. Since great care is necessary in breeding and protecting the silkworm, and in preparing silk for the market, the industry can succeed only where labor is not expensive. During colonial times, the British government was vitally interested in promoting silk culture in some of the American colonies. There were no physical difficulties in the way, but since tobacco was the more profitable industry, and because labor was scarce and expensive, the planters could not afford to cultivate the silkworm. More recent attempts to develop the industry in the United States have failed for the same reason.

Naturally, in countries like India and China, which are poorly equipped for the supply of industrial information, the annual production of silk is more or less a guess. But we may obtain some idea of the importance of the industry by the extent of the foreign shipments. Exports from Shanghai and Canton in 1925 amounted to about 18,000,000 pounds. The exports through Yokohama, which convey some idea of Japanese production, were about 57,000,000 pounds; British India, and Indo-China shipped about 198,000 pounds. Italy was the largest producer among the Mediterranean countries, with over 9,000,000 pounds; and smaller quantities were produced in France and Spain, and in some six or eight countries in eastern Europe, in the Levant, and in Central Asia.

LINEN

Flax supplies two important commodities for commerce, namely the fiber, which is the source of linen, and the oil from the seeds, known as linseed oil. In some countries the plant is cultivated chiefly for the oil, in others the fiber supplies the motive for cultivation. Flax is cultivated in many parts of the world, and the fiber has been used for textile purposes from ancient times. The material is most often used alone, but is sometimes mixed with other fibers, as with cotton or wool. The pioneers in America manufactured a product known a linsey-woolsey, which was a coarse cloth of linen and wool. Flax is grown for the seed both in the United States and Canada. Minnesota and North Dakota are the principal sources in this country, although smaller quantities are produced in Kansas, Nebraska, and Wisconsin among others. Argentine produces large quantities of the plant, chiefly for seed; the fiber is burned after harvest. Russia produces both for the seed and fiber. This country is the chief source of supply for the linen-manufacturing countries which do not produce enough flax locally for domestic needs. In fact, flax is one of the most important exports of Russia; the United Kingdom and Germany are the chief consumers. Considerable quantities are produced in Belgium, Holland, and Ireland, mostly for the supply of the home industry. The manufacture of various products of linen have reached highest development in Scotland, Ireland, France, and Belgium. The fiber is used in the manufacture of twine, canvas, and laces, but by far the larger proportion is used in the production of linens, the qualities of which may vary from very coarse fabric to materials which rank among the best of textile wares.

In harvesting the crop the worker pulls up the plant by its roots. The next step is to remove the seeds by drawing the flax through an iron comb. The fibers are enmeshed in a gummy material which binds them to a woody core, and the next step is to separate the fibers, which is done either by exposing them to the elements in a damp meadow (dew retting), or by soaking the stalks in a pool, or in running water. The dried stalks are later passed through fluted rollers which break up the woody material. They are then scutched or beaten to remove the woody portion, and heckled or combed to separate the long from the short fibers.

HEMP

Jute, hemp, and sisal are of importance to industry chiefly as the raw materials for the manufacture of rope, twine, and gunny sacks, although the natives in countries which produce these materials sometimes make use of the fibers in making fabrics. Agricultural countries in particular are large consumers of products of hemp and jute, in the form of binder twine, burlap, and gunny sack. Our foreign bill for jute in 1926 amounted to $113,300,000 and for sisal to $21,700,000. In 1925, Argentine imported more than 147,000,000 pounds of burlap.

For years Russia was almost the only source of hemp for export, and that country is still an important exporter, although jute, sisal, and Manila hemp have become competitors of the Russian product. Manila hemp has lost some of its importance in western markets, partly because of the substitution of sisal. The great distance of the Philippine Islands from the leading consuming markets works to the disadvantage of the Philippine industry, a condition which is aggravated by the crude methods of cultivating Manila hemp and preparing it for the market. The plant is known locally as *abacá*. It bears much resemblance to the banana plant and belongs to the same family. It grows in the wild state in the Philippine Islands, and attempts to introduce it in other parts of the world have met with only moderate success. The islands produced over 423 million pounds in 1926.

Some quantities of hemp are grown in the United States; Italy often produces a surplus for export; and China produces considerable quantities for domestic consumption. In fact, hemp may be grown in many parts of the world, but it is produced for export in only a few places where conditions are exceptionally favorable.

JUTE

Jute made its appearance in the markets of the world about 1832 as a substitute for hemp. But it has now become the chief fiber in a number of uses for which hemp was formerly consumed. Jute has one great advantage over all competing materials, namely, it can be produced cheaply and on a large scale. But, on the other hand, it is not as durable as hemp or cotton.

Attempts have been made to grow the plant in Mexico, Algeria, and Formosa, but without marked success. Thus India is practically the sole source of supply. The plant requires rich moist soil and plenty of heat. These conditions exist in eastern Bengal and in the Ganges-Brahmaputra delta where a large part of the country is innundated annually by these streams. The rich alluvial deposit saves the farmer the labor and expense of fertilizing the soil. Jute is prepared for the market in much the same way as hemp. Shortly before the crop is ripe, the plant is cut, and retted in water for about three weeks, and the fibers are then removed by washing and beating.

About one-third of the crop is exported as raw jute; the remainder is manufactured into gunny bags and cloth; the two latter articles are among the most important exports from India. In fact, the combined value of raw and manufactured jute which entered the export trade in 1925-1926 was about $349,000,000. The United Kingdom, the United States, and Germany are the largest consumers, but considerable quantities are shipped to France, Italy, Belgium, and Japan. In India, Calcutta is the principal source of manufacture and the mills of this city largely supply the needs of Indian consumers. Most of the product shipped to Great Britain is manufactured in Dundee and shipped thence to various parts of the world.

Jute, however, is manufactured into other commodities which at least have the appearance of quality. It is sometimes the material for the production of carpets and rugs, which, if not durable, have the redeeming quality of cheapness. It is often the fabric in linoleums and tarpaulins, and it is mixed with other materials, as with linen and cotton, in the manufacture of towels and sheeting.

QUESTIONS

1. What are the leading textile fibers? If possible rank them in the order of relative importance and explain your ranking.

2. Explain how the introduction of machinery from 1760 to 1800 changed the relative positions of cotton and wool as textile fibers. Why was this shift brought about?

3. Is it possible that the introduction of rayon may cause another shift in the position of the textile fibers? Why?

4. Are we wasteful in our consumption of the vegetable fibers and of clothing?

5. Are fads and styles elements in the wasteful use of a commodity? Is too much wealth in the hands of the people a cause of waste?

6. "One of the most interesting features in the development of a progressive people is the incessant shift from one material to another." Give a number of illustrations of this statement.

7. Why have iron and steel replaced stone and bronze?

8. Why does modern society depend on so many different textile fibers? Why would not cotton and hemp be enough?

9. Make a list of the minor fibers and tell their uses.

10. Explain why cotton has risen to first place as a textile fiber.

11. Estimate the importance of cotton as a basis for world industry and trade.

12. What revolution in methods in the textile trade and industry were brought about by the cotton gin?

13. Estimate the importance of cotton in the growth of wealth and prosperity in the United States.

14. Do you think that the United States can retain its present relative position as producer of cotton? Why?

15. What other places in the world grow cotton and what is the prospect for an increase in production in these places?

16. Is it a wise policy for producers in the United States to limit acreage for the purpose of raising the price? What else can they do to increase their profits?

17. Do you think that the McNary-Haugen plan would have brought ultimate benefit to the American cotton producers? Why?

18. What countries are the chief producers of wool? Why are these countries the leaders?

19. Trace the development of the silk industry. What of its future?

20. Describe the rise of jute and sisal. Why has not hemp held its own in competition with these newer fibers?

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CHAPTER XX

VEGETABLE AND OTHER OILS

Some vegetable oils have been used for centuries, but the new feature of the industry is the systematic manner in which industry is now exploiting the vast resources of oil-producing substances. Not only the olive, as of old, but the seeds of the cotton plant, the peanut, the soybean, the seeds of flax, and products from the coconut now supply the manifold needs of industry. And a large number of other substances yield varying quantities of commercial oils, such as sesame, mustard seed, poppy, rape and ravison, castor bean, pulgheri, niger and kapok, mowra and illipe, and this does not exhaust the list. Many uses have been found for some of these oils, as in the manufacture of food and salad products, materials for varnish, soap, for lubricating and illuminating purposes, for adulterating other oils, and compounded with other oils and animal fats in the production of margarine. The by-products of the extraction processes often serve as feed for livestock.

VEGETABLE OILS AS SUBSTITUTES

One of the most interesting features of the oil group of products is that they have been introduced as substitutes for some commodity already on the market. They are taking the place of animal oils and fats for food and cooking purposes, in the manufacture of soaps, for the production of lubricants, and to some extent in the production of illuminating materials. Vegetable oils are not only laying the basis directly for new industries, but indirectly, through the manufacture of by-products, they are bringing into existence groups of manufactures which have not existed before. Moreover, because they possess properties unlike those of animal fats, they often serve more specialized uses than the products which they are superseding. There are a number of reasons for the appearance of these substitutes. In some instances, as with cottonseed, the cause is the desire of the producer to make use of a waste material through the development of by-products. Sometimes it is a question of relative prices, as with the substitution of some vegetable oils for animal fats, because of the advancing prices of the latter, and upon some occasions the substitution is due to the fact that vegetable oils serve the purpose better than the other products formerly in use. Other reasons are the more extensive needs of present industry, and the energy of manufacturers in urging the sale of the new products. Naturally, a company which enters a new field desires to increase profits by pushing sales.

The use of substitutes is a part of the competitive struggle which takes place in every progressive society. Invention and discovery constantly produce something new, and it is the function of enterprise to promote the use of new substances. Manufacturers of older products strive to maintain their position and a competitive struggle is the outcome. Competition between producers of olive oil and the cottonseed product is an illustration of this condition. Custom and tradition are often important aids to producers of the older substances. The Moors, for example, do not consider cottonseed oil a fit article for consumption, and packers of sardines, who have used olive oil are loath to make a change from a known and tried substance to a substitute. But economic conditions often make shifts in consumption necessary. Inevitably, an advance in the price of olive oil, due to an occasional shortage of the crop, causes the substitution of some other oil, and the habit is broken. In some countries, the high cost of butter is the reason for the use of compounds made largely from vegetable oils.

Nevertheless, producers of staple products resist the change. Not infrequently heavy tariffs are levied on imported oils, partly for protecting domestic producers, partly to protect the quality of olive oil due to adulteration with imported oils. Protection is sometimes obtained by legislation requiring producers of the cottonseed product to mark the composition on the package, or through laws which require that the new oil shall be denatured.

In some cases the dealer must post a notice in some conspicuous place to the effect that margarine, or other substitutes are sold in his store. Not infrequently these signs achieve an opposite purpose by increasing sales.

COTTONSEED OIL

In America, cottonseed is the chief raw material for the manufacture of oils, although considerable quantities of oil are produced from the peanut and the soybean, both of which are being grown in increasing quantities, and this says nothing of other products, like linseed, which are produced on a large scale. Practically all these industries have developed by-products, as with cottonseed meal, cake, and fertilizers. The United States has enormous advantages in the production of oil, due to our large cotton crops, of which vast quantities of the seed are a necessary incident.

The principal uses of cottonseed are in the manufacture of oil for food and for cooking, as substitute for, or an adulterant of, olive oil, in the manufacture of margarine, and in the production of candles. Manufacture of cottonseed oil began about 1876 and grew very rapidly. In the years from 1881 to 1890 the average annual production was only 22,000,000 gallons, but it was 215,000,000 gallons in 1926, and the value of the various products which arise in connection with this manufacture was $250,027,000. Production is carried on in practically all the southern states, but the ranking regions are Texas, Mississippi, Georgia, and Oklahoma.

The cottonseed industry quickly developed one of the great characteristics of many modern manufactures, namely, the use of the by-products. Thus the oil cake remaining after pressing oil from the seed kernel is ground into meal, which serves as cattle feed and as fertilizer; the impurities and coloring matter which are worked out in the process of refining are called "cotton-oil foots," and are used in the production of some kinds of soaps; hulls are employed as fuel and in the manufacture of paper. Thus the discovery of methods of utilizing seeds not only created a considerable number of new industries, but added immensely to the value of the cotton crop.[1] Large quantities of oil, meal, and cake are exported, but the quantities vary from year to year depending on competitive conditions, of which the status of the other oils is an important factor.

This industry has been developed on a large scale in some other countries which grow cotton, notably in Egypt, which exported more than 355,000,000 pounds of cottonseed cake in 1926, to say nothing of large quantities of seeds.

India, also, is becoming a large exporter of cottonseed oil, although local conditions often have a bearing on the amount available for export. "If there is a good monsoon, so that grass and other feed for cattle are in plentiful supply, perhaps one-half the cottonseed grown may be exported. When however, there is any failure in the monsoon, the Indian farmers are averse to selling their cottonseed for export, but hold it over for winter feed for cattle."[2] The United Kingdom is the principal market for the Indian product.

SOYBEAN

The production of the soybean has reached its highest development in China where the article is used for a great many purposes, in many cases as a substitute for animal products, including milk. Beans are consumed not only as food for human beings, but as feed for animals, and for the manufacture of oil, paste, toilet powders, bean curd, and "soy." Very little of the product is wasted. The residue after pressing is made into cakes which are widely used as a fertilizer; the oil is in general use for cooking, and in the manufacture of soaps, paints, and lubricating and illuminating materials. Chinese cooks have developed great skill in converting bean products into food materials which so nearly simulate other products that it would be difficult for some persons to detect the difference. In no place in the world does a single article serve such a general utility purpose as does the soybean in China.

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[1] I. Lippincott, *Economic Development of the United States,* 2nd ed., p. 435.

[2] *India,* Trade Promotion Series, No. 38, p. 380.

The crop is most important in Manchuria which grows about 70 per cent of the total Chinese output. Data bearing on production are of course inaccurate, but estimates place the production of this region at nearly 4,000,000 tons. Japanese enterprise has developed technical and marketing machinery for handling the bean trade. This includes even experimental stations where experts study improved methods of production. South Manchuria contains rather extensive equipment for tank transportation and storage, and other means for handling oil in bulk. Possibly half the production of Manchuria is destined for manufacture into bean cake and oil, and because of these improvements, Dairen has become the principal point of export. Large quantities of soybeans are grown for local consumption and so serve the various purposes named above.

In 1926 the exports of soybeans and their products from China amounted to about $93,000,000. Japan is the largest importer of beans and bean cake, but oil is exported to a number of places including Great Britain, Siberia, The Netherlands, and the United States. The soybean is grown to some extent in Japan, and it has been introduced recently into the United States where production, during the last fifteen years has shown a marked increase.

PEANUTS OR GROUNDNUTS

The peanut of the United States is often called groundnut in other portions of the world. But there is little in the name, for the product serves about the same purposes everywhere. The nut is rich in oil, and a first-rate food product, qualities which recommend it highly for production and use. China and India are among the largest producers in the world, although peanuts are grown both for local consumption and for export in more than half a dozen countries including the United States. Upwards of 26,000,000 bushels were produced in this country in 1926.

Although the big peanut was introduced by an American missionary into China, this country now produces many times the quantity grown in America. The entire peanut production of China is estimated at 900,000 tons annually. The method of extracting the oil is about the same as is used in case of the soybean. In some countries the oil is used as a substitute, and as an adulterant, for olive oil. Large quantities are consumed in the manufacture of margarine and soap; the peanut cake makes excellent cattle food, and in some cases the flour can be manufactured into certain kinds of bread. Peanut products, such as peanut butter and oil, are familiar to American consumers. Production of groundnuts is an important industry in India, where about 2,000,000 acres are devoted to the crop. Over half the crop is produced in Madras, and smaller quantities in Bombay and Burma. Considerable quantities are grown also in France and Portuguese West Africa, and in Gambia and Nigeria.

It may seem strange to students of American history that the humble peanut is the only commodity for exchange in some parts of the world, and that it is the sole means of making purchases from the outside world, but this is the case. In Senegal, groundnuts are the main crop, and Gambia has been described as a one-staple country with the peanut holding this distinction. The natives live far in the bush, possibly because of the remembrance of the days of the slave raiders. Peanuts are transported to market on the backs of donkeys. The natives insist on payment in silver, because of their distrust of paper money, and they promptly spend their hard money at the trading post and disappear into the bush until the next season.

COCONUT OIL

Copra, the dried kernel of the coconut, is one of the most prolific sources of oil. The coconut palm, which supplies so many useful products, such as cabinet wood, palm sugar and coir used for matting, brushes, and brooms, is even more useful in the supply of oil. The Netherlands East Indies are sources of copra. The Indies exported more than 773,000,000 pounds in 1925, but large quantities were shipped from British Malaya (415,000,000 pounds), from Ceylon (270,000,000 pounds), and from the Philippine Islands (157,000,000 pounds). Smaller shipments were made from India, the West Indies, Mauritius, the Gold Coast, and Zanzibar, among others. The European countries usually derive their supplies from regions with which they have the usual trade contact. Portugal, for example, imports largely from Angola, Cape Verde, Guinea, San Thome and Principe, and Mozambique. There are many sources of supply and the chief question with the importers is the trade relationships.

The coconut palm is a tropical product which thrives best, at least in the native state, near the sea. In fact, it has been maintained that its nearness to the coast has been one reason for the wide diffusion of the plant in the tropical areas. Thus it has been said that "coconut palms which grow by the seashore often bend over towards the sea, and so nuts often fall into the water. Their outer covering of fiber makes them light in proportion to their size, and so they are carried along by ocean currents until they reach another shore. Sometimes they are washed up on a little barren island and are the first plants to sprout and grow

Ewing Galloway

Opening coconuts for copra in the Philippines

there."[3] However that may be, the plantation product has been cultivated at some distance inland.

In recent years, coconut oil has been used extensively in the manufacture of artificial butter, in the production of soaps and candles, and in certain medical preparations. Dessicated coconuts, as distinguished from copra, are used in the bakery trades both in the United States and in Europe. The meat, or poonac, which is the residue after the oil has been extracted, is used as cattle food and as fertilizer.

The manufacture of coconut products has become an important industry in certain European centers. Large quantities are treated at Marseilles, Liverpool, and Hamburg. Marseilles is one of the most important seats of the vegetable-oil industry in Europe, and imports into this city consist not only of peanuts and copra, which are the most important, but of rape, poppy seeds, sesame, mowra, and several others. Nearly 600,000 tons were imported in 1909. Although the industry was depressed during the war period, it has begun to regain its old position. The production of butter from the oil is of growing importance because of the relatively high price of the real product. In some countries, as in Italy, olive oil spread on bread, serves the purpose of butter, and in some central countries of Europe the fat of pork or other meat is used in a similar manner. If necessary, the well-to-do classes can afford anchovy paste, caviar, and other fish products, but such delicacies are beyond the reach of those with small incomes.

Coconut butter is often manufactured in Europe by patent processes and under exclusive trade names. In Germany, the oil is treated with bone black, fuller's earth, and lime to remove taste and odor, and then mixed with various ingredients to give the proper color and taste. Although coconut butter lacks some of the wholesome qualities of real butter, it contains a fair amount of nutriment, it does not easily become rancid, and it can stand a relatively high temperature without melting.

In some countries of origin copra is sun-dried, and in others it is dried by mechanical means. The latter is usually considered the most desirable, not only because it contains a higher percentage of oil, but because it reaches the foreign markets in better condition. The growing use of margarine in Europe is probably an indication of what will take place in the United States with the gradual rise in the price of butter. In fact, substitution is already taking place on a considerable scale. It can hardly be said that the industry is new in the United States, but it can be maintained that consumption is increasing. The total production of oleomargarine in this country in 1926 was 248,000,000 pounds which was about twice the amount manufactured in 1910. The American manufacturers of margarine use large amounts of vegetable oils as can be seen from the appended table.

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[3] J. C. Cunningham, *Products of the Empire,* p. 130.

Materials Used in the Manufacture of Oleomargarine, 1925

Material	*Pounds*
Oleo oil	47,418,000
Coconut oil	98,307,000
Cottonseed oil	25,608,000
Milk	72,662,000
Peanut oil	5,257,000
Oleostearine	5,314,000
Neutral lard	25,172,000
Butter	2,330,000
Salt	20,593,000
Miscellaneous	1,717,000
Oleo stock	3,082,000
Total	307,460,000

LINSEED OIL

The chief use of linseed oil is in the manufacture of paints and varnishes, and enormous quantities are consumed for this purpose. This oil, which is extracted from flaxseed, is produced in large quantities for export in Argentine, Russia, India, China, and to some extent in the United States, Canada, and The Netherlands. Other countries produce small quantities for domestic use. Linseed oil has one valuable property which makes possible its extensive use in the painter's trade, namely, that of taking up oxygen when exposed to the air, and of being converted by this process into a smooth, hard, dry substance. Thus, when applied to walls or floors it quickly forms a protecting surface, and at the same time fixes the pigments or waxes to the painted surface.

For this reason it is the most widely used of the drying oils. During the process of manufacture it is boiled with certain chemicals called "driers." In recent years, certain wood oils have become competitors of linseed because of their superior drying qualities. The product of flaxseed, however, has the advantage of being an agricultural commodity, the volume of which can be readily adjusted to the demands of the market. In addition to its use in the manufacture of paints and varnish, linseed also enters into the manufacture of oilcloth, patent leather, soaps, lithographic inks, and linoleum. As with a number of other seeds, the oil cake, produced from the residue of the pressing process is sold as feed for cattle. In the manufacture of linoleum, the ground dry linseed is ground with cork and gum which is spread upon fabric of some kind and then rolled.

Linseed is one of the chief exports of Argentine, this commodity usually ranking third or fourth in the shipments from that country. The value of the shipments in 1926 was over $102,000,000. Flax is one of the principal agricultural products of Russia; the plant is grown both for fiber and for seed. Large quantities of linseed are exported along with such other oil-bearing products as rape, sunflower, hemp, and mustard seeds.

Besides linseed, China produces several other painter's oils, of which tung, or wood oil, is the most important. It is said to be superior to linseed, particularly in the manufacture of varnish. For one thing, exposure to hot water does not whiten or soften the film, as is the case with most other painter's oils. It is also used in the manufacture of linoleum and oilcloth. In 1923 the United States imported about 12,000,000 gallons of this material. About 90 per cent of Chinese wood oil is produced in the upper Yangtze region and the product is exported through Hankow. The supply is not large in view of the great potential demand. The tung trees, which produce the oil-bearing nuts, cannot be increased to meet the potential demand, and further limitations are placed on the supply due to the crude methods of extracting oil, and to heavy taxes laid on the product on the way to market through Chinese territory. The Chinese have used tung oil in native industries for centuries. It forms a lacquer varnish and it is used for waterproofing wood, paper, silk, and other materials. The soot is manufactured into certain kinds of Chinese inks.

Both the Chinese and Japanese industries use large quantities of lacquer, or "Ningpo" varnish, but the poisonous qualities of this material have retarded its use in western countries. Hitherto, Japan has taken practically all the Chinese surplus. This material is obtained from a tree which grows in western Hupeh and in eastern Szechwan. "It furnishes only one color, black, and is considered the most indestructible varnish known. Brown varnish is obtained by adding 'pei-yu,' which is crude wood oil, boiled for an hour into a sirupy oil; and red, by adding cinnabar to the brown in equal parts. This varnish hardens only in a moist atmosphere, and in China is applied only during moist or cloudy weather. In indoor work drying is facilitated by hanging about the room cloths saturated with water." [4]

POPPY-SEED OIL

In Anatolia the oil of the poppy seeds is a part of the daily diet of the peasant, and this condition usually prevails in all the regions where the poppy is grown. The exported oil is used in producing artists' oil paints, as salad oil, and in the manufacture of soaps and varnishes. A total suppression of the opium trade would not prevent the growing of poppies for the reason that the oil is an important commodity in commerce; in some regions it is the sole source of buying power, and it enters into general consumption for good purposes in most of the countries where the poppy is grown.

SESAME AND RAPESEED OILS

China and India are the most important sources of sesame. The production of rapeseed is a little more widely distributed. In addition to India and China, commercial supplies are obtained from Russia and Argentine. The Chinese use sesame for cooking, as an illuminating material, and in the production of candles. In other countries it is used as a table oil and sometimes as an adulterant for olive oil, and in the manufacture of margarine; the poorer grades are consumed in producing soaps. Rapeseed oil is used in soap making, and it is one of the oils used in quenching steel. In China, the tender shoots of the plant are consumed as food.

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[4] *China,* Trade Promotion Series, No. 38, p. 234.

It appears from our discussion that the industries which make use of vegetable oils must tap a great variety of natural resources, and in addition, they must draw supplies from practically every region of the earth. In many cases, some of the most important oils are obtained from tropical areas, and in others from sources where the product can be grown cheaply with an inexpensive labor force. The demand is increasing for all these products, and in many cases prices have already begun to reflect the growing demand. Fortunately, in most instances, the supply is susceptible of enormous increase. A large proportion of the world supply of vegetable oils is obtained from countries which still pursue primitive methods of production, and waste characterizes the industries in all the processes from field or forest to foreign consumers.

Importers in the United States spend upwards of 70,000,000 dollars a year for foreign oils. Coconut oil is the most important, and palm oil usually ranks second. But imports consist of considerable quantities of sesame, rape, linseed, soy, and peanut oils, to say nothing of such essentials oils as geranium, citronella, lavender, lemon, orange, attar of roses, and sandalwood.

OILSEEDS OF INDIA

The oilseed industry of India is noteworthy not only because of its volume, but on account of the variety of seeds which the country produces. In the year 1925-1926 India shipped overseas about 2,797,700,000 pounds of oilseeds and nuts, and this, of course, was only a part of domestic production for the reason that the Indian population is a large consumer of vegetable oils. Local mills are usually crude enterprises but they serve an important purpose. In most cases the power is supplied by bullocks, and even hand presses are in existence in many parts of the country. But in recent years steam mills have become a part of the enterprise in a few of the larger cities. These establishments press all the commoner seeds.

Notwithstanding the introduction of modern mills it is still to the advantage of India to ship her products in the form of seeds rather than as oil. Some of the difficulties which retard the export trade in oils are the protective tariffs of a number of European countries, the better market for oil cake in Europe than in India, and the lower cost of transporting seeds in bulk than of shipping oil. If the last-named condition seems anomalous it is explained by the fact that oil must be shipped in casks, drums, and tins, which are not returnable on account of the cost, and these conditions add to the expense of shipping oil.

The oil-seed shipments include linseed, peanuts, rapeseed, sesame (gingeli), cottonseed, castor beans, copra, mahwa seeds, poppy, mustard, and Niger seeds.

All the western nations of Europe are large importers of Indian products. Poppy seeds, for example, are shipped to France, Belgium, and Germany; mahwa to Germany and Belgium; mustard seeds to France and Belgium; Niger to Germany and France; copra to Germany, Belgium, and France; and linseed, peanuts, and rapeseed have even a wider European distribution.

PALM OIL

The African oil palm is the source of palm oil. The fruit is collected by the natives, immersed in hot water to soften the pulp, which is then separated from the stones or seeds, and the oil is squeezed from the pulp. Pressing is a hand-labor process and, as usual with such methods, it is most wasteful of oil. Subsequently, the stones are cracked between two stones, the kernels are sorted out and exported to consuming countries where the oil is extracted. In view of the crude methods employed, including gathering, pressing, and transporting to shipping points, some of the West African regions export enormous amounts of the palm products. In 1914, for example, Senegal exported 115,800 tons of palm kernels, Gambia in 1918 shipped about 640 tons, and the Ivory Coast about 4,700 tons. Palm oil is used in the manufacture of soaps and candles, and the oil from the kernel is consumed in the manufacture of margarine. The cake is used as feed for animals.

ESSENTIAL OILS

These products are usually the most expensive class of oils. They are produced in small quantities, and the process is usually slow and costly; this is reflected in the selling price, as is well known by every consumer of attar of roses. Some of these oils are obtained from the leaves or petals of flowers by "enfleurage," which consists of pressing the flowers on cloth which has been saturated with lard, or olive oil, or some other fatty substance; the oil is then extracted by dissolving in alcohol. Oil from oranges and lemons is pressed from the rinds. The chief use of essential oils is in the manufacture of perfumes and flavoring extracts. Many perfumes are now made by synthetic processes, that is, by manufacture from certain chemicals. In this case, man has outdone nature, at least in variety, and usually in quantity, if not at times in quality.

Some of the natural raw materials for the production of essential oils are lavender, bergamot, bitter orange, geranium, tuberose, bitter almond, hemlock, cedar and spruce, wintergreen, mint, sassafras, cloves, orange, lemon, peppermint, anise, caraway, rosemary, wormwood, sandalwood, bay, and many others. These materials must be sought in practically every region of the earth.

Attar of roses is obtained chiefly from Bulgaria and from Turkey, and due to the righ price, there is a great temptation for producers to adulterate the product, with the result that careful buyers pay their bills only after an analysis of the substance; even local certificates guaranteeing the purity are not acceptable. Oil from the sandalwood is obtained principally from a few districts in India; the industry is controlled by European firms who are agents for medicine manufacturers in Europe and the United States. As with attar, producers find it difficult to resist the temptation to adulterate the product. Sandalwood "is a delicate tree and suffers much from injuries inflicted on the bark and stem, and for this reason it flourishes best when protected by thorny jungles, etc." However, in northern India, it is a cultivated plant although it loses something of its aromatic flavor when taken from its natural surroundings. Bay rum is obtained from the leaves of the bay tree which grows profusely in some of the Danish West Indies. The leaves and twigs are distilled with alcohol, although by a more primitive process the leaves are distilled in a retort, and subsequently mixed with alcohol or water.

QUESTIONS

1. Why does modern industry demand so many types of vegetable oils?
2. Name the chief sources of vegetable oils. What are their commercial uses?
3. Are competitive conditions largely responsible for the introduction of the vegetable oils? Give illustrations.
4. Does substitution of the new oils disrupt old trade relations? Why?
5. Describe the rise of cottonseed oil as an article of commerce. Explain why it has come to occupy an important place in consumption.
6. What countries are large producers of cottonseed oil?
7. Estimate the economic importance of the soybean in China.
8. Discuss the utility of the peanut.
9. What are the uses of coconut oil? What countries are large exporters of oil and copra?
10. What are the chief uses of linseed oil? What countries produce flax?
11. Is it possible to greatly increase the world supply of vegetable oils? Give illustrations.
12. Describe the oil industry of India.
13. Name some of the most important essential oils. From what parts of the world are they obtained?
14. Has the introduction of synthetic oils affected the trade in natural essential oils? Are there other illustrations of inventions of new products affecting the sale of the old?

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CHAPTER XXI

RUBBER

Although rubber is now used for many purposes, the automobile trade is the chief source of demand, and the rise of the rubber industry since 1900 has been due principally to the expansion of the automobile business.

HISTORY OF RUBBER

Many kinds of trees, shrubs, and vines contain a juice or latex from which rubber may be produced, but at present the cost of production and the quality of the raw products are factors which decide from what source production is to be obtained. In recent years, the plantation industry has driven many producers of the wild product from the market, and has rendered conditions uncertain even for those who remain. Plantations are organized on a large scale, the locations for such enterprises are carefully chosen not only with reference to suitable growing conditions for trees, but with thought for such economic factors as supply of labor, means of transportation, and relative distance to the consuming markets. Financial control has much to do with the location of the industry, and with the channels over which crude rubber moves to market.

The early Spanish explorers in America were attracted to rubber because of its unusual elastic qualities. They observed that the people of Hayti played a game with a ball made from the "gum of a tree," and that this ball was larger and bounced better than the wind-balls of Castile. Upon a number of occasions this interesting product was described in scientific papers, but for several hundred years Europeans could find little or no use for it. Possibly it was consumed first as erasers. At any rate, Joseph Priestley, the scientist, remarked that it was a novelty for erasing pencil marks, and named the selling price as 3s. for a cube of about a half inch. In 1830 only 46,000 pounds of crude rubber were imported into England, and in 1850 only 7,600,000 pounds.

One of the first important uses was in the manufacture of waterproof cloth. About 1823, Macintosh showed that rubber could be used for this purpose; but there were certain serious drawbacks. If the weather was too hot the material became sticky and gummy; if too cold, it was brittle. In 1842, Goodyear discovered accidentally that when sulphur was mixed with rubber the old fault disappeared. This new discovery introduced the process of vulcanizing rubber. It now became possible not only to manufacture a satisfactory waterproof cloth, but to "proof" boots and shoes. In recent years, the development of the electric industries has added to the demand for certain kinds of rubber not only for protection against the elements, but as insulating materials. The appearance of the bicycle and, since 1900, the development of the automobile industry added enormously to the demand for rubber. Some kinds of rubber, such as balata, jelutong, gutta-percha, caoutchouc, and guayule, serve more or less specialized purposes.

PRODUCTION OF RUBBER IN LATIN AMERICA

The first commercial supplies of rubber were obtained from Brazil. Small amounts were shipped from the province of Pará as early as 1827. The Brazilian industry received the benefits of the demand arising from the discovery of methods of vulcanizing rubber, and not only were larger shipments made from Pará, but other regions became exporters. Meanwhile, new resources were opened in the basins of the Madeira, the Purús, and other tributaries of the Amazon. Peru exported rubber in 1853, Bolivia in 1865, shipments from Venezuela came down the Rio Negro and the Amazon in 1866, and the first shipment from Colombia was sent out in 1869. With the acquisition by Brazil of the territory of Acre from Bolivia, and with the development of transportation on the upper Amazon, this new territory became an important producer. In 1912 the output of Amazonia was

45,060 tons, of which the Brazilian regions contributed the greater amount.

Since that date, Brazilian production has suffered more and more from the growing competition with plantation rubber. The peak year for Brazil was 1913; since that date the business has become a most "precarious and demoralizing undertaking." Although located at a great distance from the chief consuming market, namely the United States, plantation producers of the Middle East have advantages with which producers in Brazil cannot compete. The eastern companies have invested enormous sums not only in plantations, but in labor-saving equipment which reduces cost; they have much more ample supplies of labor, and their business organization is much more effective than that in Brazil, partly because it has been ordered on a prearranged plan, instead of the natural arrangement such as exists in Latin America.

Brazil has tried to cope with the competitive conditions in the rubber industry with the same policy that was applied to coffee, but competition has been too intense for the successful operation of the scheme. Moreover, with the rapid development of the industry in the East, Brazil soon became a minor factor in the rubber market, whereas she dominated the coffee trade. Plans for the valorization of rubber failed, and the Bank of Brazil, which invested large sums in rubber—which was withheld from the market—lost money.

Subsequently, the Brazilian government put into operation a project for "the defense of rubber." The elements of the new scheme were contained in a proclamation of January 5, 1912. These included premiums for planting rubber trees, with additional grants for owners who cultivated food products between the rows of rubber. Experiment stations were to be established, means of transportation improved, factories were to be erected for refining and standardizing rubber, and immigrant hotels and hospitals were to be established at convenient places. But all to no purpose. The plans were too extensive for the limited funds available, and lack of administrative experience added to the troubles of the government. The result was that most of the enterprises were abandoned.

Although Brazil contains enormous areas of natural rubber, production has continued to decline in face of competition from the plantation product. Exports in 1913 were 79,000 tons, and only 51,200 tons in 1926. Due to the decline in price of crude rubber, the shrinkage of the value of the exported product has been greater than the decline in shipments of the physical product, namely, from 50,000,000 dollars in 1913 to about 16,500,000 dollars in 1926. Brazilian forests contain a number of types of rubber trees but the most important are *Hevea brasiliensis* and *Hevea benthamiana.* The former grows almost entirely on the south side of the Amazon, while the other variety is confined to the borders of the northern tributaries of that stream. Brazil has great resources which have never been tapped. Some explorers have estimated the number of rubber trees at 300,000,000. Probably the

greatest area of virgin or untapped rubber trees in South America is in the highlands of Northern Matto Grosso east of the Madeira and Guapore rivers and in southern Amazonas and Para. Very little of this area has been explored away from the rivers. The writings of explorers who have traversed parts of it and verbal reports of people who have penetrated the country all point to the existence of an enormous number of rubber trees which have not yet been exploited—and which cannot be exploited until better means of transportation are provided.[1]

COLLECTING RUBBER IN BRAZIL

The operator establishes a base at some convenient place, usually on or near the bank of the river. Workers thread their way from tree to tree, the whole circuit forming a loop which brings them back to the starting point. Occasionally, side paths lead from the main trail to near-by groups of trees. The trees are tapped with a small hatchet. Cuts are made in parallel lines, from two to ten, depending on the size of the tree. A notch is made after each incision, into which a cup is fitted to receive the latex.

This liquid is collected each day and brought to a smoking hut where liquid is converted into crude rubber. The equipment includes a small furnace with an open galvanized iron cone to concentrate heat and smoke. Palm nuts are added to the fire and soon a "clear, white, dense smoke, rich in pyroligneous acid and creosotic vapors, is hissing from the funnel." Starting with a small ball of coagulated rubber pressed around a smooth pole, the worker alternately pours latex on the ball and revolves the mass over the funnel of the furnace. In a few seconds the latex is coagulated and consolidated with the ball, and this process is continued until a mass has been accumulated weighing from 60 to about 120 pounds. This rubber is collected for export at Manáos, some thousand miles up the Amazon, or at Pará. Peruvian rubber is collected at Iquitos in Peru and delivered at Manáos or Pará for export.

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[1] Trade Promotion Series, No. 23, p. 40.

The system of financing rubber production is complicated, but the upshot of the matter is that the great burden of low prices and inefficient organization rests on the shoulders of the seringueiro, that is, the small individual proprietor who possesses but little capital, and who works with advances of money or merchandise obtained on credit from the large supply houses at Pará, Manáos, or Iquitos. In most cases the seringueiro obtains only merchandise. The sale of rubber is credited to his account, and he is usually in debt as a result of the annual transactions. There is no system of accounting, and no one seems to know the cost of production, but there is a general impression that there is no money in this commodity, and that the only profit is in the sale of merchandise.

POSSIBILITIES FOR PLANTATION RUBBER IN LATIN AMERICA

Scattered through the Amazon Valley are small patches planted to *Hevea brasiliensis,* but these bear no resemblance to the great plantations of the East. Plantations which were started in the northern part of tropical America made use of the Castilla tree, which proved a failure. The product is inferior to Pará rubber produced from Hevea, and the tree cannot be tapped as often. As a rule the planters have failed to study soil conditions; they have lacked knowledge of the best planting methods, and they have not pursued a systematic system of cultivation. Several experts connected with our Department of Commerce who have surveyed the Latin American rubber conditions have expressed the opinion that plantation rubber can be made a profitable enterprise in this area. "With proper methods of soil preparation," according to this survey, "seed selection, care in planting, and proper upkeep afterwards, there seems to be no inherent reason why the planted Hevea in a large part of the Amazon basin should not be in every way comparable to that of the Middle East, with the possible exception that, due to the more marked dry season in the Amazon, to reach the tapping age might take a little longer."[2]

THE PRODUCTION OF RUBBER IN CENTRAL AMERICA

Rubber is produced in all the Central American countries, but the amount is very small—less than a thousand tons annually for the whole region in every year since 1900. Thus, Central America is more interesting in its possibilities than in its present production. With respect to physical factors, there are no reasons why a considerable plantation industry should not be established. The cost of land is low, from $1.00 to $5.00 an acre; the soil in certain areas is said to be superior to that which can now be obtained in the Middle East; there are no destructive grasses to trouble the planter; and in some cases the soil and topography are suitable to the use of plows. Nearness to the great consuming markets in the United States is also a great advantage. Moreover, many districts are already supplied with suitable transportation.

The one factor which seems to stand in the way is the high labor costs. The basic wage in the Middle East is practically 20 cents a day, and even with the addition of costs for housing, sanitation, recruiting, and hospital care, the total daily labor cost is not above 35 cents, but the prevailing daily wages in Central and South America, at least in the banana districts, which possibly would establish the standard, are from $1.00 to $1.50 a day.

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[2] *Ibid.*, p. 43.

GUAYULE RUBBER

Guayule, a shrub which grows from 18 to 24 inches high, offers some interesting possibilities for the supply of rubber. The plant yields about 11 per cent of rubber by weight, although the substance is not entirely pure, being mixed with resinous materials. Guayule will grow in very dry, and even rocky regions, and for this reason it could be cultivated on land which could not be used for other purposes. At present, the plant grows wild over an area of about 29,000 square miles in northern Mexico, and it is estimated that it could be cultivated on from 115,000 to 130,000 square miles; and this says nothing of rather extensive regions in the southwestern part of the United States where the plant would probably thrive.

Guayule first became of commercial importance in 1905, and production increased rapidly for several years, reaching the maximum in 1910, when the output was almost 10,000 tons. This industry has suffered along with other Mexican enterprises because of political disturbances, and the unsettled condition of the rubber market has been a discouraging factor. Guayule is used for specialized purposes, and for mixing with other rubbers.

THE RUBBER INDUSTRY OF THE MIDDLE EAST

The change in relative position of wild and plantation rubber in the last twenty years is shown by the fact that in 1905 the production of plantation rubber was only 174 tons and that of wild rubber from tropical America and Africa was 59,320 tons. Since that date the plantation product has constantly increased until 1924 it amounted to 386,700 tons. The relative production of the two kinds is shown in the table on page 423.

There is some irony in the fact that the seeds from which all plantation rubber trees in the Middle East have descended were obtained from Brazil. Not a little ingenuity, and a great deal of patience, were required to transport and adapt the plant to its new habitat, and the mortality among the early trees was

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[3] Adapted from Trade Promotion Series, No. 2, p. 5. Figures for 1924 estimated.

World Production of Plantation and Wild Rubber in Certain Years from 1905 to 1924

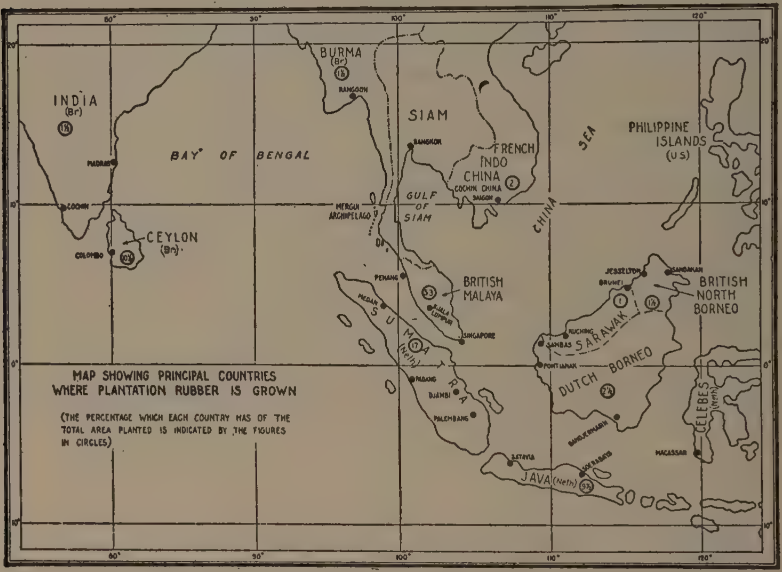
(*tons*)

Year	Total Plantation	Wild (Tropical, America and Africa)	World Production	Per Cent Plantation
1905	174	59,320	59,494	0.3
1910	7,269	73,477	80,746	9.0
1915	114,277	54,740	169,017	67.6
1920	304,671	36,464	341,135	89.3
1924	386,703	28,000	414,703	93.2

great. In 1876 Sir Henry Wickham obtained in Brazil the seeds of *Hevea brasiliensis*. These were germinated in the Kew Gardens in London, and sent thence to the East. Some years of experiment were required to adjust the plants to their new surroundings, but eventually the experiment was a success. What the plantation producer needed as much as anything else was the price stimulus, but this was supplied shortly after 1900 with the rapid increase in production of automobiles.

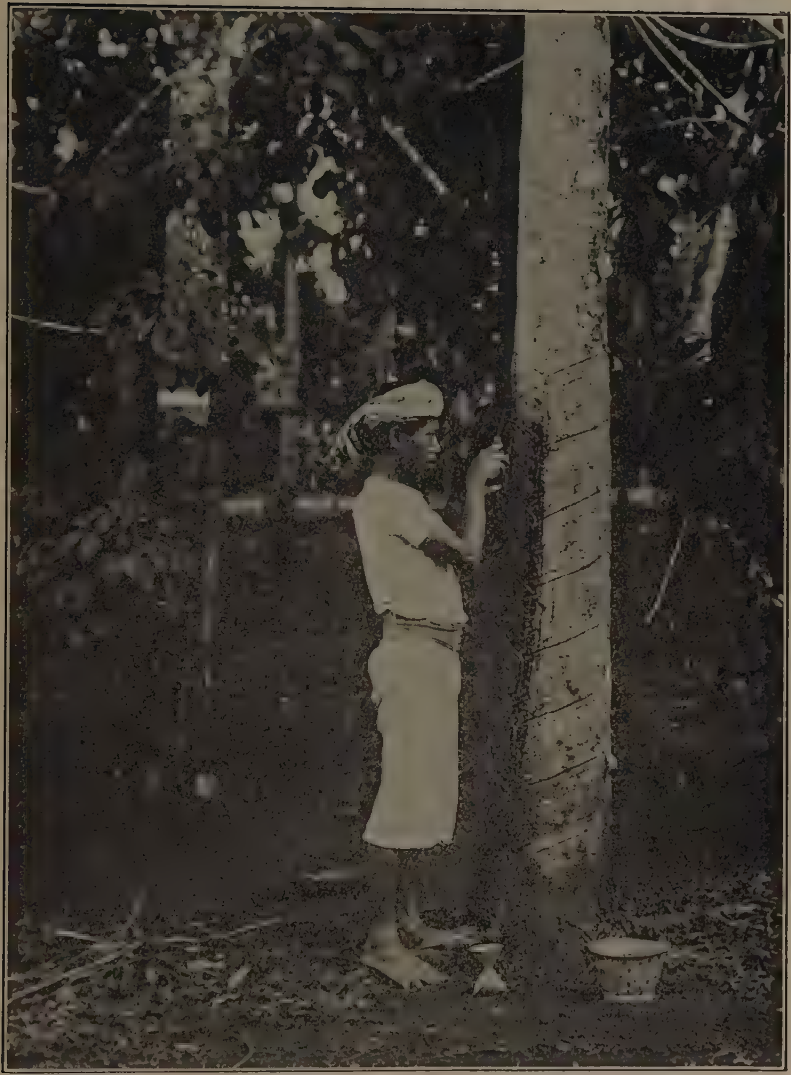
In a former chapter we discussed the effect of foreign investments on the development of resources. The development of the plantation rubber industry is an outstanding illustration of the influence of such investments. Practically the whole industry has been promoted by foreign capital. In 1924, the approximate investments in plantations in the Middle East was $876,000,000, of which British capitalists supplied $505,000,000. Upwards of $130,000,000 was provided by capitalists of the Netherlands, and $32,000,000 from the United States. Capital was also supplied from France, Belgium, Japan, Denmark, and from other countries. That the British dominate the industry is apparent from this statement. In fact, in 1924, British control was even greater than the percentage of total investment would indicate. In a special survey made at the instance of our Department of Commerce about 1924 it was shown that British-owned plantations aggregated 3,230,000 acres, or about 75 per cent of the total area devoted to plantation rubber.

There can be no doubt about the effectiveness of foreign capital in opening new resources. If anything, these investments were too effective for the good of the owners, for the reason that shortly after 1920 the plantations began to supply more rubber than the market could conveniently consume. The depression which beset the industry called forth the customary demands for combination and control, which finally materialized in the Stevenson Restriction Act, which became a law November 1, 1922. This measure has been discussed in a former chapter. An interesting aftermath of this measure was a prompt investigation by our Department of Commerce for the purpose of learning the possibilities for producing rubber in other parts of the world. At this time the American Secretary of Commerce reported that combinations controlled sisal, potash, nitrates, coffee, and tannins, of all of which American industries consumed large quantities, and in some cases the great majority of the world output.


MAP SHOWING PRINCIPAL COUNTRIES WHERE PLANTATION RUBBER IS GROWN
(THE PERCENTAGE WHICH EACH COUNTRY HAS OF THE TOTAL AREA PLANTED IS INDICATED BY THE FIGURES IN CIRCLES)
INDIA (Br) 1½
BURMA (Br) 1½
RANGOON
MADRAS
COCHIN
COLOMBO
CEYLON (Br) 10½
BAY OF BENGAL
MERGUI ARCHIPELAGO
SIAM
BANGKOK
GULF OF SIAM
FRENCH INDO CHINA 2
COCHIN CHINA
SAIGON
CHINA SEA
PHILIPPINE ISLANDS (U.S)
PENANG
BRITISH MALAYA 53
KUALA LUMPUR
SINGAPORE
MEDAN
SUMATRA (Neth) 17
PADANG
DJAMBI
PALEMBANG
JESSELTON
SANDAKAN
BRUNEI
BRITISH NORTH BORNEO 1¼
SARAWAK 1
KUCHING
SAMBAS
PONTIANAK
DUTCH BORNEO 2¼
BANDJERMASIN
CELEBES (Neth)
MACASSAR
BATAVIA
SOERABAYA
JAVA (Neth) 9½
80°
90°
100°
110°
120°
20°
10°
0°
10°

Production of plantation rubber in the East Indies

The Stevenson Act was regarded as a temporary measure, that is, until consumption could overtake plantation capacity, and



Ewing Galloway

Tapping for rubber on a Javanese plantation it was estimated that this would take place about 1930. This control has been abandoned, at least temporarily.

In fact, such plans of control are probably of only temporary benefit, and they bring into existence new sets of forces which are beyond the control of the combinations. For one thing, all producers are not on the same cost basis, and in one way or another, producers with a low cost take advantage of those who do not have this advantage. They usually strengthen their position in the expectation of future competition, and while the effect of these machinations does not appear in the market at once, it emerges at some later date to trouble the members of the combination. Moreover, no satisfactory methods had been discovered of alloting output among producers, and if these are not troubles enough, competition from new producers usually makes its appearance, if the regulated price promises a profit which is higher than the prevailing rates. Not infrequently, substitutes are introduced which diminish the sale of the real product.

With respects to the cost of production, one of the American reports makes the following comment: ". . . for well-managed, foreign-owned estates in the Middle East, the cost today of planting and maintaining an acre of rubber to the producing stage would vary from $150 to $325 U. S. currency, to which must be added interest during the growing period. With interest included, the cost would probably range between $200 and $400 per acre." There is difference enough in cost to cause great difficulty for those who would try to stabilize production, but this is not the whole story. The report continues with the following comment: "In production costs also there is great divergence. Location, yield per acre, cost of labor, health conditions, efficiency, and management all vary over a wide field."[4] The table on page 427 shows the present location of planted area.

It must be obvious from what has been said that conditions inherent in the business make for irregularity of production. The tree does not yield annually. Moreover, from four to six years are required before the tree comes into bearing, and it does not reach the full-bearing stage until ten or twelve years. Depressions tend to check planting, with the result that in time the consuming market is undersupplied. These are only a few of the factors which make for irregularity of the supply.

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[4] *Ibid.*, p. 7. Table from the same report, p. 1.

AREA PLANTED TO RUBBER, THE MIDDLE EAST, 1924

Country	*Acres*
Malaya	2,275,000
Netherlands India	1,249,000
Ceylon	445,000
India and Burma	124,000
North Borneo, Sarawak, and Brunei	117,000
French Indo-China	86,000
TOTAL	4,296,000

THE PRODUCTION OF RUBBER IN AFRICA

Small quantities of rubber are produced in a number of regions in Africa, including British, French, Portuguese, and Belgian colonies, and in Liberia. Maximum shipments were made in 1906, amounting to 20,500 tons for all regions. The continent contains a number of varieties of wild rubber, Manihot, Castilla, Landolphia or vine rubber, and *Hevea brasiliensis*, among others. In the whole continent not more than 40,000 acres are grown with the plantation product. No doubt some regions possess advantages for production compared with the Middle East. Among other things, the practice of mixed agriculture in Africa enables growers to produce rubber "at much lower costs than in the East. . . . One American company which is operating a plantation in one of the Gulf countries has stated that its production cost per pound is lower than the figure which is accepted as reasonable in the Middle East."[5] Labor supply is abundant in most regions, with wages ranging from 10 to 30 cents a day, but the difficulty in maintaining an organized labor force is a great drawback.

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[5] *Ibid.*, No. 34, p. 7.

THE RUBBER-LIKE GUMS

Industry is as exacting in its demands upon the vegetable kingdom as upon the minerals. There are many kinds of rubber-bearing products, each of which is used in some specialized way in industry. The connoisseur of chewing gum probably does not know that this substance is classified as a rubber-like gum, but the elastic qualities of the substance ought to suggest its relationships. This use is also highly specialized. Chewing gum is usually produced from the latex of chicle (*Achras zapota*), but it is sometimes obtained from a mixture of chicle and jelutong, and even of other rubber-like substances. The tree from which chicle is obtained grows wild in Yucutan, British Honduras, and Guatemala. These regions are still the chief sources, but other substances which differ in composition from chicle, and which are used as components in the manufacture of chewing gum, are obtained from the tropics of the Middle East, from Venezuela, the Guianas, Colombia, and the Amazon Valley. Jelutong, which is one of the substitutes, is exported mainly from Singapore. Like rubber, chicle is obtained by tapping the tree. The latex, which is thin and white, is brought to camp, heated until the test shows that it hardens on cooling, and it is then cooled and kneaded into blocks weighing from five to fifty pounds. As a rule, a tree will yield from two to six pounds, although trees in British Honduras have been known to yield twenty-five pounds, and on one occasion an output of sixty-one pounds was said to have been obtained in Mexico. In 1925, the United States imported 12,145,000 pounds of chicle, which seems to be remarkably small in view of the visible evidences of consumption. Due tc the gradual exhaustion of the native product, and to the inaccessibility of the remaining supply, chicle may become in the near future a plantation product.

Although gutta-percha is sometimes considered a rubber product, the botanical relationship is not the same (*Palaquium gutta*), and it serves different industrial purposes. This substance was introduced into Europe in 1843. A few years later, Dr. Werner von Siemens suggested its application as an insulator for submarine cables, a use which now absorbs much of the product.

But it now enters into industry in many other ways. Utensils made of gutta-percha are a part of the equipment of chemical laboratories for handling hydrofluoric and other acids. It is consumed, also, in the manufacture of tissue, adhesive tape, buckets, ladles, bottles, spigots in chemical laboratories, various kinds of cements, and covers for golf balls. Inferior guttas are sometimes blended with other gums in the production of chewing gum.

The gutta-percha of commerce is obtained from various trees belonging to the family of Sapotaceæ. The supply is gathered in Malaya, Sumatra, Borneo, Java, and the Philippine Islands. The industry is in the hands of the natives, but Chinese merchants control the marketing of the product. The natives deliver the gutta to Malay or Chinese traders who frequent the producing regions. The product then moves to various small seaports where it is again sold to other dealers who travel in junks from port to port, and finally, the output of many regions is concentrated at Singapore, which is the international center for the gutta-percha trade. "Sometimes the gutta passes through as many as six hands before reaching the Singapore market. In this way practically all the wild gutta produced in Borneo, British Malaya, Sumatra and other West India Islands, and the Philippines goes to Singapore for refining and reshipment to American and European consumers."[6]

Balata, another rubber-like substance, is produced chiefly in the northeastern part of South America, including the Orinoco region of Venezuela, in the Guianas, and in Pará, Colombia, Peru, and Bolivia. One of the most important uses of the substance is in the manufacture of waterproof belting. Since the product used for this purpose is not vulcanized, care must be taken not to employ such belting in places where the temperature is too high. The process of manufacture consists of impregnating heavy cotton-duck fabric with balata gum. Balata is sometimes mixed with gutta-percha and with rubber in the manufacture of various specialized articles. The tree itself supplies timber for the production of spokes, shingles, railway ties, and for construction work. Although balata is a hard wood, it is relatively easy to work because of the remarkable regularity of the grain and freedom from knots. In many places the method of extracting the latex is first to fell the tree and then to make various incisions in the trunk. Although this process yields a larger amount of latex than the ordinary process of tapping, it destroys the resource, and as a result the supply has been greatly depleted. As with other rubber-producing substances, the topical forests contain enormous numbers of trees, but as a rule these are inaccessible except at a high cost of exploitation.

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[6] *Ibid.*, No. 41, p. 15.

THE RUBBER TRADE OF THE WORLD

If for no other reason, the mere fact that more than 80 per cent of the motor cars in the world in 1925 were owned in the United States would cause the United States to be the largest world consumer of rubber. Our imports in 1926 were nearly 400,000 tons. This great volume of trade in rubber is of recent origin. In fact, imports in 1870 were only 5,000 tons, and in 1911 only 72,000 tons. The imports of the various countries are given in the table below.

NET IMPORTS OF RUBBER BY PRINCIPAL COUNTRIES, 1926

Country	Long Tons	Country	Long Tons
United States	399,972	Russia	6,529
United Kingdom	84,866	Netherlands	2,671
France	34,238	Belgium	2,498
Germany	22,775	Sweden	2,126
Canada	20,216	Austria	1,781
Japan	17,615	Czechoslovakia	1,753
Italy	9,810	Spain	1,299
Australia	8,782		

QUESTIONS

1. Trace the rise of rubber as an article of commerce.
2. What are the chief sources of rubber, and of rubber-like substances? What are the relative merits of each?
3. Explain why the producer of plantation rubber is driving many producers of wild rubber out of business.
4. Why did not the Brazilian scheme for the "defense of rubber"

succeed? Contrast this system of control with that for valorization of coffee.

5. Describe the system for financing rubber production and trade.
6. Is it possible to develop the plantation-rubber system in Latin America?
7. Compare the possible conditions for the production of plantation rubber in Central America with conditions in the Middle East.
8. Give the essential features about the plantation-rubber industry.
9. Discuss the Stevenson Restriction Act. Why do you think of it as a means of control?
10. Why should American consumers object to this act?
11. "Such plans as the Stevenson Act are probably of only temporary benefit, and they bring into existence new sets of forces which are beyond the control of combination." Discuss this statement.
12. Do you think that it is possible to regularize the supply of rubber? Of any great staple? Why?
13. What is chicle and what are its commercial uses?
14. Discuss briefly the rubber trade of the world.

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CHAPTER XXII

SPICES AND DRUGS

Until recent times such commodities as pepper, cinnamon, nutmeg, mace, cloves, allspice, and ginger, among others, were consumed only by the well-to-do classes. They were among the most prized of all the goods on the market. Pepper, we are told, was a gift of honor from one sovereign to another.

> In the Middle Ages a single pound of ginger would buy a sheep, and a pound of cloves was seven times as valuable; two pounds of mace were worth a cow. And pepper—can anyone today imagine it as worth its weight in silver? Yet, when Alaric the Goth captured Rome, he demanded as his tribute five thousand pounds of gold, two thousand pounds of silver and two thousand pounds of pepper. In medieval England rents were sometimes paid in pepper, and among traders it passed as a commodity of standard value, just as tobacco ranked as legal tender in the colony of Virginia.[1]

WHY SPICES WERE IMPORTANT

Every age has its disparaging epithets, as with the term "rag barons," applied to the early financiers of the American railroads to suggest that their methods were improper. And in a similar strain the phrase "pepper barons" was hurled at the German princes along the Rhine who exacted toll of vessels carrying among their cargoes spices which had been originally delivered at Venice for distribution in the northern cities of Europe.

The mere fact that spices were articles of exclusive consumption added to the demand, and was a factor in the high price, but there were other qualities which made them desirable. Those who were fortunate enough to be able to buy were attracted by the delicious flavor which the various spices imparted to food and drink; thus, Chaucer voiced the sentiment of his time when he referred to "many a spyce delitable, to eten when men ryse fro table." Possibly this quotation suggests another reason for consumption, namely, as a stomachic, or aid to digestion, which was probably a necessity at a time when the diet was monotonous. Some spices were thought to have medicinal value. Many curative properties were imputed to pepper in particular. The doctors of India, for example, used it as a remedy for cholera morbus, and prepared from the berry a liniment for treatment in cases of chronic rheumatism. Pepper was used in Europe as a stimulant in cases of gout and palsy. Some spices were used as preservative for meat, and possibly to disguise some of the unsavory qualities of this product when it was not fresh. Most of the old traditions concerning the curative powers of spices have lost their weight, and the prestige value has, of course, disappeared, but spices are now more widely consumed than ever as seasoning for food, and this age has greatly added to the list of commodities which might be described by this term, as with such herbs as sage, marjoram, parsley, thyme, anise, caraway, and coriander.

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[1] D. C. Peattie, *Cargoes and Harvests,* p. 14.

THE TRADE IN SPICES

The traffic in spices is one of the oldest organized branches of trade. Long before medieval times, spices were among the most valuable wares in the stocks of the merchants. With high value in small bulk, it was possible to transport them longer distances than any other commodities, except precious metals and stones. And if the people consumed at all, long-distance transportation was necessary, because the most valuable spices were found only in a few limited areas in the Orient. Pepper, cardamom, turmeric, cassia bark, and ginger were brought by Persian traders from India and sold to Phœnician merchants who in turn sold them among the peoples settled along the borders of the Mediterranean from Alexandria to Rome. But spices played even a more important rôle during the age of exploration and discovery, when they were not only a leading motive for discovery, but a great factor in the struggle for economic and political dominion. Until the opening of the New World, the European supply was obtained from a few places in the East, and while tropical America added a few varieties, the Orient continued to supply the most valuable kinds.

European traders were the last link in a chain of middlemen which extended back to the land of origin. For centuries, none of these intermediate handlers knew the ultimate source of their wares. John Cabot was authority for the statement that he "was once at Mecca, whither the spices are brought by caravans from distant countries, and having inquired from whence they were brought and where they grew, the merchants answered that they did not know, but that such merchandise was brought from distant countries by other caravans to their home; and they further say that they also convey from other remote regions."[2]

In professing ignorance as to the place of origin the merchants of Mecca may, or may not, have spoken the truth, more likely the latter. The trade was so profitable that those who enjoyed the monopoly did not wish to run the chance of having it diverted into other hands. Hence they kept it a secret just as the Chinese did with silk. When the Arabs dominated the spice trade they were not disposed to disabuse the European traders of the belief that Arabia was the place of growth, and not until the Portuguese sailors rounded the Cape of Good Hope and reached Calicut on the west coast of India was the secret revealed. In time, they learned that nutmegs, mace, cloves, and allspice were the products of a small group of islands, namely, Banda, Amboina, Ternate, Tidore, and a few others of the southern Moluccas. They learned also that pepper came from the Malabar coast of India, and that cinnamon was obtained from Ceylon.

In the years before the navigators discovered an all-sea route to India the spice trade of Europe centered at Venice. But with the new discoveries it passed into the hands of the Portuguese who pushed it with great vigor, stimulated by the lure of enormous profits. Thus, it was said that "when the news [*i. e.*, that da Gama had visited Calicut] reached Venice the whole city felt it greatly and remained stupefied, and the wisest held it the worst news that had ever arrived."[3] The Portuguese East India Company enriched its owners during the hundred years of its supremacy. Subsequently, the Dutch gradually penetrated into the most valuable regions and finally took over the trade. "Today the eastern possessions of Portugal consist only of a few obsolete ports in India, parts of the sandalwood island of Timor, and the port of Macao. This city was founded in 1557, hard by Canton, and now represents the oldest European settlement in China."[4] The Dutch fared much better, for although they were compelled ultimately to share both trade and dominion with the English they have retained some of their most valuable Eastern possessions. One significant feature of these centuries of rivalry is that the fruits of mercantile progress have been gradually shifted to the great mass of consumers. Spices are no longer a luxury to be consumed only by the rich. In many places foreign capital has now been invested in the business, with the result that the world is adequately supplied with spices—too well supplied at times, since producers often complain of overproduction.

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[2] Quoted from E. P. Cheyney, *European Background of American History*, p. 12.

PEPPER

The pepper plant is a climbing shrub, which, in the wild state, attains a height of from twenty to thirty feet. The plant bears a red berry about the size of a pea. The stems are cut before the berries are ripe, and are spread out in the sun to dry. At the proper time the berries are separated from twigs and leaves and prepared for the market.

There are upwards of forty different species of the pepper plant, growing in the form of herbs, shrubs, and trees. From some of these species are now obtained the various kinds of pepper of commerce. The East is still the important source of black pepper, although the plant is cultivated to some extent in the United States and in the West Indies. Supplies are also obtained from the Malay archipelago, Java, Sumatra, and from Siam and Cochin China. Long pepper, a commodity often used in the fall for pickling purposes, is a native of the Indian archipelago. It is found along the streams in Sumatra, Celebes, and Timor, and it occurs in Malabar, Ceylon, East Bengal, and the Philippines.

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[3] J. C. Cunningham, *Products of the Empire,* p. 106.

[4] Peattie, *op. cit.,* p. 25.

Capsicum, or cayenne pepper—or to give the other names, Guiana pepper, Spanish pepper, Mexican chili, or red pepper—comes from Zanzibar, Bombay, and Penang; true Mexican chilies are produced in Tabasco, Mexico. This product is consumed extensively in India, Mexico, the West Indies, and certain portions of Africa.

GINGER

This product has lost nothing of its popularity since the Middle Ages. In fact, consumption has been diversified by the application of the product to many new uses. Today, China exports about 6,000 tons of fresh and preserved ginger, and this says nothing of large quantities which are consumed at home. The product is grown largely in the Kwangtung and Szechwan provinces. Galangal, which is sometimes mistaken for ginger, is a product of the island of Hainan and off the Kwangtung coast. The consumable part of the ginger plant is the underground rootlike stem. Production is widely distributed, China, Japan, India, Sierra Leone, and Cochin being among the exporters. The best grade of white ginger is exported from Jamaica.

NUTMEG

The tree, *Myristica fragrans*, produces two important spices, namely, nutmeg and mace. The latter is a substance covering the inner shell of the nutmeg, which is cut into strips and dried. The nutmeg is the kernel of the fruit inclosed in three layers of substance. A liquid distilled from the poorer grades of nutmegs and from mace is a kind of essential oil used chiefly in the manufacture of perfumery. The plant is a native of the Moluccas, but it is now cultivated in a number of places in the East, in certain of the West India islands, in French Guiana, and in Brazil.

PIMENTO OR ALLSPICE

The sense of smell or taste—or the imagination—may have been more highly developed in medieval times than at present; at any rate, consumers of that time thought they could detect in pimento the flavors of all the spices, including cloves, cinnamon, and pepper, hence the name allspice. The word pimento signifies pepper, with which the product has been associated in commerce, although it belongs to the myrtle family. The tree is a native of the West Indies, and it is the only common spice which has been contributed by the New World. Jamaica is one of the principal sources, although small quantities are produced in most of the West Indies, and in Mexico, Costa Rica, and Venezuela.

CINNAMON

The tree which yields cinnamon is indigenous to Ceylon and since no other section of the world has been found where the tree will thrive as well, this island has practically a monopoly of the product. But an inferior quality is obtained from Senegal, from India, and from some of the West Indies, and cassia, which resembles cinnamon in many respects, is produced in China and the East Indies. Moreover, cassia oil is used for about the same purposes as the oil of cinnamon, namely, in medicine, as a base for perfumery, and as a flavoring extract. It is obtained by distilling the leaves and twigs of the cassia. China exports some 5,000 tons anually of this commodity.

Cinnamon is one of the oldest of the spices—valued particuarly because of its pleasant aromatic flavor. The essence permeates the whole tree, but as a rule only the bark is prepared for market. The plants are cropped or cut in such a way that only a few shoots are allowed to grow from a single base. In due time these shoots are cut and the bark is then removed by making incisions lengthwise and around the stem. The pieces are scraped to remove the outer layers of bark—a process which often reduces the strip to a thickness of less than one-fiftieth of an inch.

The strips are then made up into little rolls by inserting the smaller pieces in the larger, and after further drying these rolls are tied into bundles and started on their way to market. The plantations of Ceylon are called cinnamon gardens.

CLOVES

This spice was one of the great prizes of the medieval explorers. As with other commodities of this class, the native habitat was not known until the successful discoveries of the Portuguese. The Dutch, who finally expelled these traders from the Moluccas in 1605, obtained a complete monopoly of the product by destroying the clove-bearing trees in most of the producing regions and by concentrating production in the Amboina islands. The French finally succeeded in introducing the tree into Mauritius in 1770. It was later taken to French Guiana, Zanzibar, and the near-by island Pemba. Production is now rather widely distributed, with Java, Sumatra, Reunion, and some of the West Indies adding to the export trade. The principal supply, however, comes from Zanzibar and Pemba.

The spice is the flower bud which is harvested before the petals open. After drying in the sun the product is ready for export. The spice is unusually rich in essential oils. Cloves are used in the culinary arts and in the manufacture of confections and liqueurs. Cloves also serve a number of medicinal purposes, and this is true also of the oil which, in addition, is a flavoring extract and a raw material for the manufacture of perfumes.

DRUGS

The *materia medica* of the people of the world contains a vast number of substances only a few of which have real medicinal value; all the rest are worthless, at least for the uses to which they are usually put. We who live in countries with a highly developed medical service do not realize that most of the vast population of the world still relies on home remedies which have been handed down through the generations; in some of the more primitive countries we can still find the medicine man who cures by mystic arts aided occasionally by the administration of concoctions obtained from certain herbs. In fact, in all civilized countries today we are not far removed in years from medical practices which are much like those in vogue today among the peoples of the more backward nations.

In England, until 1617, the common drugs and medicines were sold both by grocers and apothecaries. In that year it was enacted that grocers should not keep apothecary shops. At that time, some medical mixtures in a single prescription contained from 20 to 70 or more ingredients; the mixture often contained a repetition of the same ingredient, under the assumption that similar products from different regions possessed different properties.

Diagnosis was in a crude state, and the science of compounding drugs was conspicuous by its absence. Weird and fantastic reasons were given for the selection of many drugs, and tradition, and often imagination, dictated the choice of remedies. The pharmacopœia of the apothecary, some two or three hundred years ago, contained such substances as crabs' eyes, pearls, oyster shells, coral, human skulls, and the moss from the human skull when this object has been exposed to air and dampness; the list included also powdered toad skins, the excrement of certain animals, as well as a vast number of herbs, plants, gums, spices, oils, cordials, wines, and even alcohol. The apothecary used also a number of inorganic substances, such as compounds of mercury, arsenic, and iron.

If we pride ourselves on our medical progress we should not forget that even in America in colonial times medical practice was not much different from the methods described above. At that time, the science of medicine had scarcely begun to develop. There were no medical schools, and the only education a young man could get was to trail the doctor from home to home and watch his methods. Medical information was not obtained by careful experiment, as the doctor learns it today. Superstition and tradition played a large part in the diagnosis of diseases and in the administration of remedies. Diseases of the blood, as they were called by the doctors of the day, were treated by administering medicine compounded largely from powdered toads. All sorts of quack medicines and nostrums were given to the unfortunate patients to drive away disease. The practice of bloodletting was a customary treatment for many ailments, and if a physician could not be found to do the job, a barber, or a clergyman, performed the work quite as well. Family remedies played a large part in the treatment of diseases, and it was one of the duties of the women of the household to prepare the remedies and to care for the patient. The practice of medicine is in this state in many parts of the world today, and this is no doubt one reason why some of the backward countries are such large consumers of patent medicines.

Out of this confusion, there developed in time a number of drugs of real value. They were not always used properly, largely because the doctor did not understand the art of diagnosis. But when properly employed these drugs were effective remedies. One of the most important, perhaps the one of greatest value, was quinine, obtained from the bark of a tree which grows in some of the west coast countries of South America. This list would include the oil of the castor bean, nux, ipecac, rhubarb, and ginseng, remedies long prized by the Chinese; belladonna, aconite, and licorice root, produced in abundant quantities in Turkey, the Caucasus, Syria, and Mesopotami; gum tragacanth from Anatolia and Persia, used not only as a medicine, but in glazing paper, in the manufacture of varnishes, in finishing cotton goods, and in sticking the outer leaf of cigars. Coca leaves, a source of cocaine, are used by the natives of Peru as a stimulant, and as a medicine by the drug trades; and in some parts of Africa the kola nut is chewed for its stimulating effect, and it is used in the trade as a medicine and stimulant. We might add copaiba, which yields a balsam prescribed for dysentery and bronchitis, and used for disinfecting wounds; also sarsaparilla; and opium, used both as a medicine, and also as a narcotic; and camphor, obtained chiefly from Formosa, and used as a medicine and in the manufacture of celluloid and smokeless powder. Some persons, no doubt, would include tobacco in the list of drugs. The modern manufacturer produces not only a great variety of patent medicines, but many synthetic drugs which contain both organic and inorganic substances.

QUININE

In view of the veritable plague of fevers, including malaria, which beset the white races in many parts of the world we cannot but accept the following estimate of the importance of quinine: "This medicine, the most precious of all those known in the art of healing, is one of the greatest conquests made by man over the vegetable kingdom. The treasures which Peru yields, and which the Spanish sought and dug out of the bowels of the earth, are not to be compared in utility with the bark of the quinaquina tree which they for a long time ignored."[5]

The Indians of Peru named the bark quinaquina. The tree is called chinchona—an honor to the family name of Conde de Chinchon whose wife was relieved of fever by the use of the bark. The Count of Chinchon was a Spanish viceroy stationed at Lima, Peru. According to the story, the governor of Loja, in Ecuador, hearing of the illness of the countess, sent some of the bark, and, in the parlance of the time, it effected a magical cure. Thus we may fix the year 1638 as the time when the curative powers of quinine became known to the Spanish. Large numbers of the trees were formerly grown in the Ecuadorian province of Loja and the bark was exported through Paita. A number of species of the tree are found in Peru; but the industry in this region has largely lost its significance, because of the wasteful methods of exploitation. Due largely to the efforts of Sir Clements Markham who went to Peru in 1860 for the purpose of obtaining plants or seeds, cultivation was begun in the Nilgiri Hills in India, and has spread from this source to other places in the East, including Burma, Ceylon, southern India, and Java.

OPIUM

This substance is obtained from the juice of the opium poppy. An incision is made in the unripe capsule, from which is exuded a milky juice. Upon exposure to the air this hardens into a brown gummy substance, which is the raw opium of commerce.

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[5] *Dictionnaire des sciences médicales,* quoted from Cunningham, *op. cit.,* p. 144.

As with many commodities, consumption of opium may result in good or harm, and thus, in some of its uses, opium is a great blessing, and in others one of the greatest curses known to man. The medicinal uses have been of great benefit in relieving pain, in procuring sleep, and in alleviating nervous disorders, but millions of smokers and eaters of opium have been ruined by the habit.

The medicinal properties of the drug have been known for several thousand years, but the use for other than medical purposes is of much more recent origin. Until about the twelfth century, opium produced in Asia Minor was the only product which reached the channels of trade. Cultivation probably did not spread to India until the sixteenth century. It is believed to have been introduced into China by the Arabs toward the end of the thirteenth century, but it was very sparingly consumed during the next four hundred years. Under the régime of the East India Company, the opium trade with China was pressed with great enterprise, and notwithstanding the prohibition of the Chinese authorities, consumption spread among millions of the people. Not only did imports of opium into China increase, but the growing of the poppy was begun in a number of the provinces. Opium eating is a habit chiefly in Asia Minor, Persia, and India. Smoking is practiced in China and in some of the islands of the Indian archipelago.

Anatolian and Macedonian opium is rich in morphine, from 11 to 15 per cent, and these regions are therefore among the most important sources of supply. Although, before the late war, Turkey was a large producer—some 281,000 acres were devoted to production in 1919—the people of the country neither eat nor smoke the drug. But the oil derived from the poppy seed is consumed generally by the Anatolian peasant for cooking purposes and as a substitute for olive oil.

TOBACCO

A party sent out by Columbus to explore Cuba brought back reports of natives who carried firebrands with which they ignited fires, and who perfumed themselves with certain herbs

Franciscans who accompanied Columbus on his second voyage observed Indians using snuff, and Spanish explorers on the east coast of South America in 1502 discovered Indians chewing tobacco. In fact, before the coming of the Europeans, tobacco was produced throughout the Americas and was widely consumed in one form or another. One of the most remarkable features in the history of tobacco is the rapidity with which consumption spread over many parts of the world, and this is all the more noteworthy when one remembers that, except for ocean travel, there were in those days no convenient means of communication.

The first tobacco was brought to England by Sir John Hawkins about 1565, but Sir Ralph Lane and Sir Walter Raleigh did most to popularize the use. The habit was soon acquired not only by courtiers but by the common people. In its rise as an article of commerce tobacco was compelled to run the gauntlet of "counterblast of a great monarch, penal enactments of the most severe descriptions, the knout, excommunication and capital punishment."

Although the qualities change somewhat in new surroundings, due to soil and climatic conditions, the tobacco plant readily adjusts itself to different growing conditions. For this reason it is produced in many parts of the world. In fact, there is scarcely a cultivated plant which is more widely distributed. In 1926 it was produced in at least 18 states in the United States, to say nothing of production in Cuba, Canada and Mexico; 6 European countries reported production; and it was grown extensively in South America and in certain parts of Asia and Africa.

Until the rise of cotton, from 1800 to 1810, tobacco was the most important export of the United States. It is now the second most important export of Cuba; it ranks fifth or sixth as an export of the Philippine Islands, and it ranks first among the exports of Turkey. Many sections of the world produce tobacco only for local consumption.

Some of the tobaccos of Cuba are highly esteemed because of their fine aroma. The best soils for tobacco growing—loose, rich and sandy—are in the province of Pinar del Río, in the western portion of the island, but some of the central and eastern portions produce a fairly good product. Much of the Cuban tobacco is manufactured into cigars and cigarettes, but large quantities of leaf are also exported. Cigars and cigarettes are shipped chiefly to the United States, the United Kingdom, and Spain; and the United States imports the leaf for manufacture into cigars and for mixing with other tobaccos.

The industry in the Philippine Islands has grown rapidly in importance, particularly since American occupation. The plant was introduced into the islands by Spanish missionaries in the latter part of the sixteenth century. Cultivation and sale in the provinces of Luzon was a state monopoly from 1781 to 1882, and a large part of the income for support of the government was obtained from this source. Production is most important in the provinces of Isabela and Cagayan, although tobacco is produced in a number of the islands. In former times, the Philippines exported most of the leaf, but capital has been invested in the manufacturing branch of the business since American occupation. In 1925, the factories produced about 260,000,000 cigars, to say nothing of large numbers of cigarettes. A considerable amount of these products is supplied to eastern markets, although the United States imports Philippine cigars. Sumatra and Java produce a fine light tobacco particularly useful for wrappers. Upwards of $44,000,000 worth of leaf and cut tobacco was exported from this section in 1925.

Tobacco was introduced into Turkey shortly after 1612, when a treaty of commerce was signed between that country and the Netherlands, but the qualities of the product have been changed to a marked degree, partly as a result of soil and climatic conditions, and partly due to systems of cultivation. The Turkish methods of fumigating the leaves in the process of curing also give a characteristic flavor to the product of that country. Moreover, Turkish farmers have acquired an expertness in the development of the crop from many years of specialized effort, and they have had the advantage of unusual soil conditions. Here, as in other places in the world, consumption of tobacco in the early years was placed under severe prohibitions, subject to the penalty of death, but consumption grew in spite of opposition until tobacco became such an important source of income that opposition came to an end.

Much of Turkish tobacco is suited only for manufacture into cigarettes. The chief producing districts are Smyrna, Samsun, Aidin, Brusa, and Izmid, all of which, in 1913, had some 366,400 acres under cultivation. Whether anyone but the connoisseur can detect fine differences in quality of tobaccos is open to question, but the manufacturer who produces a highly specialized article, and who has built up goodwill through an expensive campaign of advertising, must have his exact wants satisfied. For this reason, British and American firms now maintain resident buyers in Turkey who secure the exact types of tobacco required for their particular blends. Not infrequently, these foreign companies advance money to planters and supervise not only production but methods of curing. American companies buy from 65 to 70 per cent of the output of the Smyrna, and Samsun districts. The remainder is exported to Egypt and to Europe.

Burley Tobacco Growers Association

A Kentucky tobacco field in process of cutting

Although, in the United States, tobacco has lost its relative position as an export commodity, production has constantly increased. The value of the crop varies from year to year, but during the last decade it has rarely been below $250,000,000, and in 1919 it was $570,000,000. The American farmer has the advantage of an enormous domestic market. Not only are there a large number of people to consume, but per capita use, possibly with the exception of Holland, is the greatest of any country in the world. In 1925 the value of tobacco manufactures in this country was a little over a billion dollars.

The tobacco manufactures of the United States were among the first to cast their fortunes with the combined and integrated forms of industry. In fact, in the heyday of combination this organization reached out into foreign fields, and in combination with British organizations, divided the world—somewhat after the fashion of Cæsar's division of Gaul—into three parts. This organization was broken up by decree of the Supreme Court of this country and the stock was ordered distributed pro rata among the stockholders who received stock in the new dissociated companies. Whether dissolution was the most effective way of handling the problem of so-called monopoly is open to question. Since a relatively small number of stockholders of the old company were still the principal owners of stock in the dissociated companies, the community of interest still remained among the leading owners, and the problem of restoring competition was about as far from solution as when the ever diligent prosecuting attorneys took charge of the case. But at least there was some hope, namely, that present owners would die in time, or see better opportunities elsewhere, and as a result the stock in the segregated organizations would become widely distributed.

In 1926 more than 697,000,000 pounds of tobacco entered international trade. The chief exporters were the United States, Sumatra, Cuba, Brazil, Bulgaria, and Turkey. Germany is usually the chief importer, with the United Kingdom and France following in rank. This foreign trade is capable of great expansion, partly because of the growing need for different kinds of tobaccos and partly because consumption of the finished products may be increased in time.

QUESTIONS

1. Why do consumers demand such a great variety of spices? Are there not too many on the market?
2. Today pepper is a cheap article. Why was the price so high in the Middle Ages?
3. Why were spices important in the Middle Ages? Have they lost any of their importance today?
4. Discuss the influence of spices on the development of commerce.
5. Outline the rise of the direct trade in spices with the East and give the industrial and political results.
6. What is the present source of the chief spices?
7. Estimate the importance of quinine to the human race.
8. Outline the history of opium.
9. How can we account for the rapid spread of tobacco cultivation over the world?
10. Give a brief history of the development of the tobacco industry.

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CHAPTER XXIII

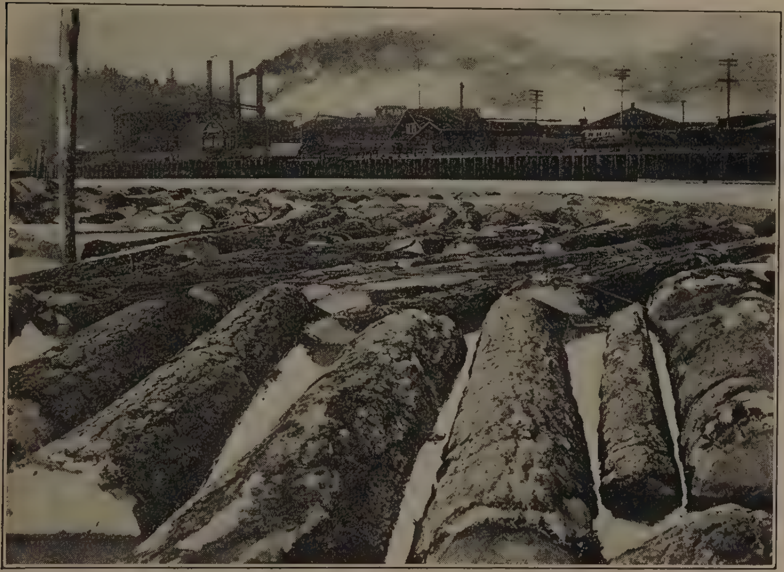
FOREST RESOURCES OF THE WORLD

Nowhere has nature shown greater capacity for yielding variety than in the products of the vegetable world. Not only does the character of plant life vary from region to region, but there is a great variety within given regions. From an industrial point of view this is a fortunate condition because it makes possible a careful selection of materials to suit the specialized purposes of production.

THE VANISHING TIMBER SUPPLY

It is difficult to imagine that at one time most of England was densely wooded, yet this was the case in the time of William the Conqueror. With regard to the United States, by far the larger portion of the country east of the Mississippi River existed as primeval forest some hundred and twenty-five years ago. But, as in England, much of this area has been cleared, partly because it was necessary to make more room for agriculture, and partly to supply the needs of industry. But withal, a considerable part of our original resource has been wasted. In fact, the great abundance encouraged waste, for even fifty years ago, no one could conceive of a time when the country would not possess an ample supply of timber. Moreover, there is always the question of using labor and capital to obtain the greatest present satisfaction. We have assumed that the future would take care of itself. Conservation, reforestation, protection of timber supply by whatever method, involves a present cost, and it is human nature to shift this burden to the future if possible.

In some of the European countries it has now become necessary to bear that burden as a part of present expense; thus the existing timber supplies are protected in one way or another, and in many cases the nations are making provision for restoring trees to the land after the mature growth has been cut. It is much easier to adopt such a policy in many European countries because of the large percentage of state-owned forests. In France 36 per cent of the forest area is state-owned, in Germany 33 per cent, and in Russia all the forest land is state-owned. Except for relatively small forest reserves in the hands of the national and a few state governments, the timber resources of the United States are privately owned.



Ewing Galloway

A modern sawmill in Washington

SUBSTITUTES FOR TIMBER

There is no doubt that waste characterizes our lumbering industry all the way from the forest through the mill, but there is some doubt as to the time when the domestic supply will be largely exhausted. One variable factor is the extent and value of the new growth, but another of equal importance is the increasing number of substitutes for timber. It was estimated in

1914, with reference to timber consumption in the United States, that the use of steel, brick, and concrete in construction saved annually more than 2,700,000,000 board feet of timber; that the use of metal, tile, and slate shingles saved 1,400,000,000 board feet; and that the substitution of fiber for wood in the manufacture of boxes saved about a billion board feet. Various other economies occur in the use of steel and concrete for fencing and posts, and in the use of steel for wood in the building of railway cars. New methods of preserving wood when exposed to the action of the elements have contributed to the same end. But consumption is increasing, notwithstanding these various economies and substitutions.

Department of Immigration of Canada

Winter hauling of logs in a Canadian forest

If it were possible to eliminate the waste in lumbering and at the mill, the annual draft upon the resources would be reduced from 30 to 40 per cent. Large amounts of merchantable timber are left in the woods either actually cut or in dead trees or in less desirable kinds of timber. Waste occurs also in long stumps and high tops, and in the failure to cut logs of such a length that the tree can be most profitably used. To this must be added loss in logging, breakage in felling, and waste by the use of good timber for temporary constructions. A more serious loss is the destruction of young timber by improper logging methods. Forest fires destroy large amounts of timber, and waste in the mill due to edging, trimming, and seasoning is no small item. But in all our discussion of waste we are apt to forget that savings are not gratuities. They involve a cost which someone must bear, and that usually means the ultimate consumer; the great problem is to decide whether to bear that cost now or to wait with the expectation that the progress of invention and discovery may relieve us altogether of the need of bearing that burden.

THE WORLD'S PRESENT SUPPLY OF STANDING TIMBER

Naturally, an estimate of the forest resources of the world must be very inaccurate. There are still many regions where the white man has not yet penetrated, and other vast regions have been judged only by superficial appearance. Taking these conditions into account, the forest resources of the world have been estimated to cover 11,700,000 square miles; in other words, an area nearly four times the size of continental United States. The distribution of these resources is shown in the appended table.[1]

Forest Resources of the World

Continent	Forest Area 1,000 Square Miles	Ratio of Forest Area to the Total Forest Area of the World, Per Cent	Ratio of Forest Area to Area of Continent, Per Cent
Asia	3,270	28.0	21.6
South America	3,270	28.0	44.0
North America	2,260	19.3	26.8
Africa	1,250	10.6	10.7
Europe	1,210	10.3	31.1
Australia	440	3.8	15.1
Total	11,700	100.0	Av. 22.5

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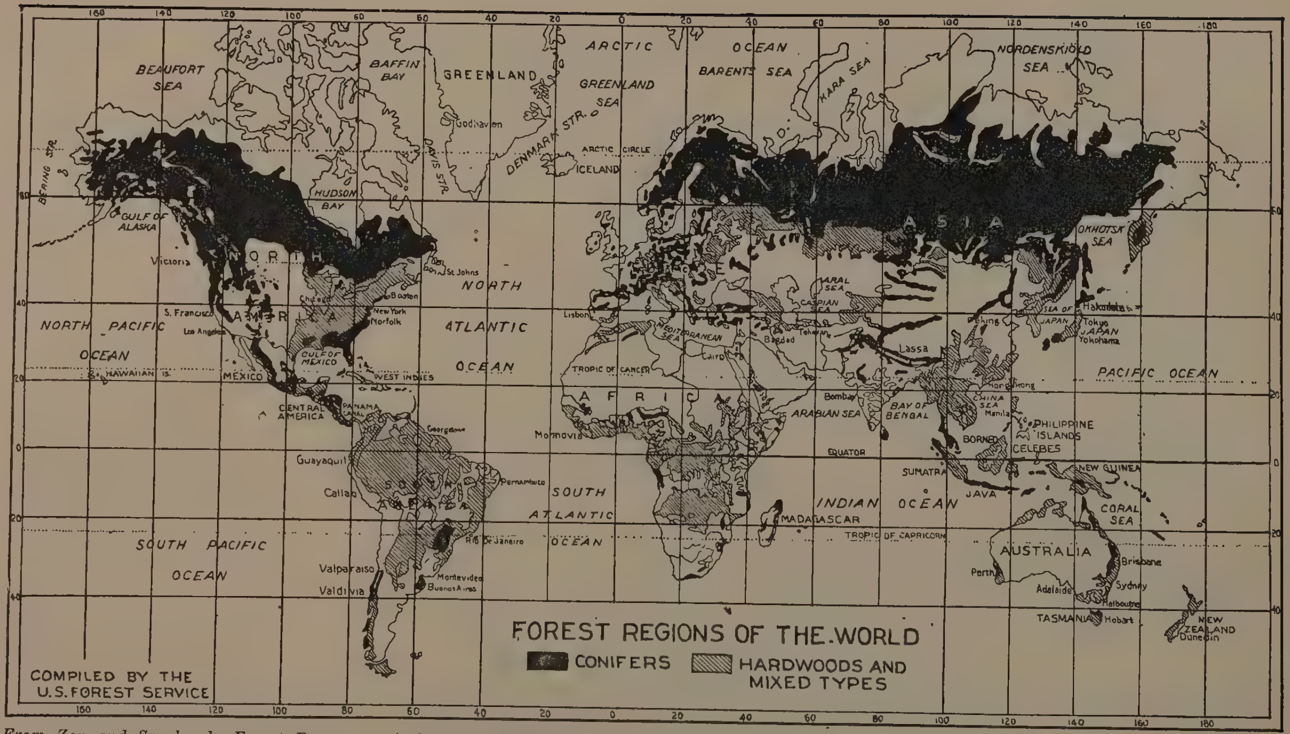
[1] *Europa,* 1928, p. 89.


FOREST REGIONS OF THE WORLD
CONIFERS
HARDWOODS AND MIXED TYPES
COMPILED BY THE U.S. FOREST SERVICE
ARCTIC OCEAN
BEAUFORT SEA
BAFFIN BAY
GREENLAND
GREENLAND SEA
BARENTS SEA
KARA SEA
NORDENSKIÖLD SEA
BERING STR.
GULF OF ALASKA
HUDSON BAY
DAVIS STR.
DENMARK STR.
ARCTIC CIRCLE
ICELAND
Godhavn
Victoria
NORTH AMERICA
S. Francisco
Los Angeles
Chicago
Boston
New York
Norfolk
St. Johns
GULF OF MEXICO
MEXICO
WEST INDIES
CENTRAL AMERICA
PANAMA CANAL
NORTH PACIFIC OCEAN
HAWAIIAN IS.
NORTH ATLANTIC OCEAN
SOUTH AMERICA
Georgetown
Guayaquil
Callao
Pernambuco
Rio de Janeiro
Valparaiso
Valdivia
Montevideo
Buenos Aires
SOUTH PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
EUROPE
Lisbon
MEDITERRANEAN SEA
TROPIC OF CANCER
AFRICA
Cairo
Monrovia
MADAGASCAR
ARAL SEA
CASPIAN SEA
Bagdad
Teheran
ASIA
Lassa
Bombay
ARABIAN SEA
BAY OF BENGAL
EQUATOR
INDIAN OCEAN
TROPIC OF CAPRICORN
Peking
Hong Kong
CHINA SEA
Manila
SEA OF JAPAN
JAPAN
Hakodate
Tokyo
Yokohama
OKHOTSK SEA
PACIFIC OCEAN
PHILIPPINE ISLANDS
BORNEO
CELEBES
SUMATRA
JAVA
NEW GUINEA
CORAL SEA
AUSTRALIA
Perth
Adelaide
Melbourne
Sydney
Brisbane
TASMANIA
Hobart
NEW ZEALAND
Dunedin
160
140
120
100
80
60
40
20
0
20
40
60
80
100
120
140
160
180

From Zon and Sparhawk, Forest Resources of the World (McGraw-Hill Book Company, Inc.)

Forest resources of the world

The estimates for South America and for Africa include many thousands of square miles of tropical forests. Timbers of such areas, however, are much less available than those of the temperate regions. Although the tropical forests contain many hard woods, and not a few of the soft variety, the thick growth of underbrush makes many regions inaccessible except at great expense, and heavy rains at certain seasons of the year add to the difficulties of the lumberman. Moreover, many of the hard woods are too heavy to float, and thus exploitation involves unusual expense. Nor is the stand of timber as regular and continuous as in temperate areas. Thus the commercial value of the tropical forests must be heavily discounted.

FOREST RESOURCES OF EUROPE

It will be observed from the table that although the area of Europe is relatively small, compared with that of the other continents, it contains about one-tenth the forest area of the world. About 31 per cent of Europe is under forest. But timber supply is very unequally distributed among the countries. It is notably small in Great Britain, Ireland, the Netherlands, and Hungary. The greatest area of soft woods is contained in northern Europe, including Finland, Sweden, Norway, and north Russia. But central Europe ranks first in actual volume of standing timber. This area includes Austria, Germany, Roumania, Poland, and the Baltic countries. Russia contains more area under timber than any other country in Europe, namely, 599,700,000 hectares;[2] Finland is next with 31,000,000 hectares; Sweden ranks third with 25,500,000 hectares; and Germany is fourth with about 18,700,000 hectares. France contains only 10,300,000 hectares, and Great Britain only 1,000,000. In addition to the firs, the European supply contains a limited amount of the walnut, now becoming very scarce; the ash which is used in the building of wagons, carts, motorcar bodies; the beech, one of the most abundant timbers, used in the manufacture of furniture, tools, and to some extent in cabinetwork, as well as for many other uses; the sycamore, used in the turning trades, as rollers for calico printing, and in the manufacture of certain musical instruments; the willow, which enters into many woodenware manufactures. Other timbers include the hornbeam, poplar, lime, boxwood, and a number of varieties of elm.

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[2] One hectare = 2.471 acres.

FORESTRY IN NORWAY AND SWEDEN

The timbered area of Norway is about 23 per cent of the total and of Sweden about 62 per cent. The greater part of the resource consists of pine (*Pinus sylvestris*) and spruce (*Picea excelsa*). The forest resources give these two countries an unusual advantage in the production of timber and its products. These industries are far more important in Sweden than in Norway. In 1926 the exports from the former of wood, rough and planed lumber, wood pulp, and matches amounted to about $145,000,000, and in addition, the export of paper and newsprint amounted to $47,000,000. Similar exports from Norway amounted to $88,000,000.

In Sweden, in particular, the economic future of the people depends to a large extent upon the conservation of the timber supply. This fact has been recognized, and conservation has become a part of the national policy. Although about two-thirds of the timber resources of the country are privately owned, these owners coöperate through various boards, institutes, and committees to maintain, and possibly to increase, the producing power of the country. They have succeeded so well that the present increment of timber is virtually equal to the cut. In fact, the timber corporations regard conservation as more profitable than indiscriminate lumbering. Thus, according to a recent report by our Department of Commerce,

> several of the large Swedish corporations engaged in pulp and paper production, lumbering, and other activities have long since determined that systematic timber growing is profitable in spite of necessarily long-term investment, and there is a growing tendency on the part of these concerns to view this work as absolutely necessary, for the possibilities of buying more forest land are restricted, while the demand for timber is constantly growing. Such companies regard timber raising as an

industry in which the chances of profitable return are not at all uncertain.[3]

Thus, Swedish producers have come to look upon the growing of timber as a kind of investment from which returns are to be obtained at some future date, possibly with the annual increment compounded at the present rate of profit. While such investments involve a considerable element of speculation, the chances seem to be in favor of the investors, in view of the prospective rise in the price of timber due to the growing scarcity.

American-Swedish News Exchange

A pulp mill at Iggesund, Sweden

As a rule, in Sweden, the method of reproducing forest areas is by the natural process. The method is either to leave seed trees standing, and to assist the new growth by getting rid of the humus, or by cutting the stand clean and sowing or planting.

Some thirty years ago the people of Sweden reached a decision as to future policy—whether they would cast their lot with agriculture or with forestry. The decision was relatively easy because much of the land area of the country which is suitable for the growing of trees is too infertile for successful agriculture. Thus the people virtually decided to grow and harvest trees instead of devoting similar attention to farming.

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[3] Trade Promotion Series, No. 56, p. 19.

Sweden began to lay a basis for a national forest policy in 1903 when a law was enacted, effective in 1905, to regulate private forest lands. The upshot of the measure was to require "forest owners who endangered the normal process of regeneration to restore growth." The law made possible the creation of district, or county, boards charged with the duty not only of spreading practical knowledge of forest economy, but of securing voluntary coöperation in the preservation of the forest. An Act of 1923 supplemented the former measure. The young productive stand of pine and spruce cannot be cut except to thin out excessive growth. Felling of trees cannot be conducted in a way which imperils regrowth, and injury to the land which prevents or retards new growth is prohibited. The boards inspect the cut-over area every three years to see that the provisions of the law have been carried out. There seems to be a friendly rivalry between Sweden and Finland, where similar conditions prevail. The total growing stock of timber in the latter country in 1926 was estimated at 57,000,000,000 cubic feet, while that of Sweden was 58,000,000,000.

FOREST RESOURCES OF SIBERIA

As with other countries which have been only partly explored, the estimates of the forest wealth of Siberia vary greatly, even when such figures have been announced to us by the authorities. One of the most conservative statements places the potential commercial supply of timber as covering some 585,000,000 acres. But it will be many years before these rich resources can be tapped. At present commercial development of timber is feasible only in western Siberia, and in the Russian Far East. Timber from the former area may be sent down the Ob and the Yenisei rivers, and from the latter, down the Amur River. The economic conditions under which this vast supply can be exploited have been stated as follows:

> It must be constantly borne in mind, that Siberia can become a participant in the world lumber trade only when conditions there favor the investment of capital and the establishment of banks and credit institutions; encourage the construction of transportation facilities between forest and port and of communication facilities between points of production and distribution; attract new classes of colonists, to afford a more plentiful and varied supply of labor; and foster the general cultural level of the country.[4]

Naturally, in such a large area, the character of the forest growth differs from region to region. But, in general, the most important trees are the conifers, including pine, larch, Siberian fir, spruce, and cedar; the forests of the west contain birch and aspen, and those in other regions, the velvet tree, ash, maple, and elm.

SOUTHERN ASIA

The forests of India, Burma, and Siam supply a large number of timbers and considerable variety of useful by-products. India is said to contain over five thousand woody species, of which about half are trees and the remainder are shrubs and climbers. An economic use can be made of several hundred kinds of native timbers. But the most important are teak (*Tectona grandis*), sal (*Shorea robusta*), and the deodar, or Himalayan cedar (*Cedrus deodara*). Other timbers of commercial importance are redwood, Burmese pynkado or ironwood, ebony, satinwood, Bombay blackwood, and sandalwood. The forests produce also a vast variety of gums, dyes, resins, drugs, fibers, and tans.

Teak grows throughout Burma and over a considerable part of the Indian peninsula. It is a very durable wood, containing a large percentage of resin which causes it to resist the action of water. The native oil prevents it from becoming waterlogged, and also serves to ward off boring insects. When fresh, the wood is too heavy to float, but it loses weight after seasoning. Teak is one of the most useful timbers in the world. It has no superior for shipbuilding, and its properties make it useful for house building, interior finish, furniture making, carving, and general construction.

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[4] B. Baivsky, *Forest Resources of Siberia,* Trade Information Bulletin, No. 378, p. 6.

Sandalwood grows in western Australia, Queensland, and in the Malay Archipelago; but it is also one of the characteristic trees of India. The heartwood is the odoriferous portion. Because of its fragrance this wood is manufactured into ornamental boxes, fans, and fancy articles of many descriptions. The tree grows only in a limited area in India, including mainly a narrow belt in Mysore about 240 miles long and 16 miles wide.

Lac is a kind of resin produced by an insect belonging to the group Coccidæ. It is found in the wild state, but it has now been brought under cultivation. The principal production is in the central provinces and in Bengal, but lac is obtained to some extent from lower Assam, Punjab, and Burma. Production is localized largely in regions which support the trees upon which the insect thrives. But extreme heat and cold bring these little creatures to an untimely end in a curious way. The resin, which the insect itself produces, melts when the temperature is high and fills the air holes and the insects are suffocated. We are told that for successful pursuit of the lac industry one must know the family history of the insect, and it will do the student no harm to learn something of the story of the active little creature which supplies India with an export commodity worth about $25,000,000 a year (1925-1926).

The insects feed upon the twigs of certain trees,

> and soon become covered with a resinous secretion that increases in thickness, protecting the body and the eggs. When a colony, consisting of a few adult females and one or two males, find their way to a new branch, they attach themselves to the bark and, having pierced it with holes through which they draw up the resinous juices upon which they feed, they become fixed or glued by the superfluous excretion, and after a time die, the females forming by their dead bodies little domes or tents over the myriads of minute eggs which they have laid. In a short time the eggs burst into life, and the young, which are very minute, swarm over the twig in such countless numbers as to give it the appearance of being covered with blood-red dust. Generation after generation

dwells upon the same twig until it is enveloped in a coating of the resinous exudation often half an inch thick.[5]

The exports of this material are mainly in the form of shellac or button lac. This substance is used for a variety of purposes —in the manufacture of spirits, varnishes, sealing wax, as an ingredient in lithographer's ink, and as an insulating material in the electrical industries. Other forest products of India are turpentine, resins, cutch—used as a dye for nets, sails, etc., and mahua seeds, the oil of which is manufactured into butter and lubricating and illuminating oils. Sugar and molasses are also manufactured locally from the mahua. The flowers of the mowrah or mahua tree are edible, and as dried material they are cooked with cereals.

Southern India also contains its characteristic kinds of trees, such as ebony, Indian mahogany, nux vomica, rubber, pine, eucalyptus, and white cedar.

CHINA

This country is an importer rather than an exporter of lumber, although some regions export small quantities. Great areas in China were denuded of their forests centuries ago to make room for agriculture, but local supplies of considerable importance are found scattered throughout the country. In the Antung district, for example, where lumbering is an ancient industry, the resources consist of Korean red pine, white pine, and larch, and a few hard woods, such as oak, walnut, ash, and chestnut. In the Foochow area small quantities of pine are produced for export.

The bamboo is a useful tree in many parts of the country, as it is in Japan, India, and the East Indies. It sometimes grows a foot in diameter and may occasionally reach 100 feet in height. It is a general utility timber, used for many kinds of construction, the manufacture of furniture, agricultural implements, canes, fishing rods, fence timber, mats, hats, screens, brooms, and musical instruments, to mention only a few of its uses. A valuable feature is its great tensile strength in proportion to its weight.

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[5] *British India,* Trade Promotion Series, No. 72, p. 404.

The Chinese consume bamboo shoots as a vegetable. Walnuts are exported to some extent. Nutgalls are among the by-products of the forests—used in tanning leather, dyeing, and the manufacture of inks. This substance is caused by the puncture of the gall wasp for the purpose of laying its eggs—chiefly on oak trees. Vegetable tallow is a product peculiar to China. The fruit of the tree (*Sapium sebiferum*) is dried in the sun. The interior contains seeds which are covered with a fat or tallow. This is separated, pressed into cakes, and delivered to the trade under the title of *Pi-yu,* while the oil extracted from the seed is the *Ting-yu,* of commerce. The Chinese use both tallow and oil in the manufacture of candles. When the tallow reaches America and Europe it becomes the raw material for the manufacture of high-class soaps and face creams.

THE PHILIPPINE ISLANDS

Most of the Philippine woods are relatively hard and heavy. Some are very durable and beautiful in color and grain. A recent report of our Department of Commerce divides the Philippine woods into four classes. The first consists of timbers which are hard, heavy, strong, and durable, suitable for heavy exposed construction work and for first-class cabinet work in the Tropics; this class contains also some less durable woods, suitable for various specialized uses, such as the manufacture of cigar boxes. The second group consists of a considerable number of durable woods which do not exist in large enough quantities to make commercial exploitation possible. The third group contains the bulk of the Philippine timbers which may be used for commercial purposes, including export. Most of these have excellent grain; they possess fine finishing qualities and may be used, therefore, for cabinetwork and interior finish. Some are sold in American markets under the title of Philippine mahogany. This group contains the timber apiton, which is a well-known export timber. The fourth group contains such timbers as the lauan and almond, and several others belonging to the lauan family, which are classed as light-colored Philippine mahogany. Although the forest area is not large, containing some 46,000,000 acres, many of the timbers are useful for specialized work, and are exported chiefly for such a purpose. The present annual output of timber in the Philippine Islands is estimated at about 190,000,000 board feet, and this could be materially increased without impairing the resource. Conditions of logging, however, are more difficult than in the temperate areas because the best species are scattered through the forests. Among the other difficulties in extending exploitation are the scarcity of skilled labor, the distance of the forests from harbors and railway lines, and the fact that much of the timberland is thickly overgrown with vines, shrubs, and forest plants which impede the work of the lumberman.

AUSTRALIA AND NEW ZEALAND

Australia contains important forest resources located chiefly in the eastern and southern parts of the continent, and the island of Tasmania is about two-thirds forested. The principal trees include the ironbarks and a number of kinds of eucalyptus. The forests of New Zealand seems to be approaching exhaustion; but for some years this country will be able to supply the market with at least one important forest product, namely, kauri gum—the solidified turpentine, mostly fossilized, the product of the kauri pines. The gum fields cover about 700,000 acres north of the city of Auckland. The prosperity of this city has been due in part, at least, to the gum trade. The forests of kauri which covered much of the gum fields are being rapidly exhausted. In fact, the better grades of gum are disappearing from the market, and traders are having recourse to the lower qualities, of which there are upwards of a hundred different grades.

A few years ago, when the high-grade products dominated the market, the United States was the chief consumer, kauri being used mostly in the preparation of varnishes. The lower grades are now being more largely exported to Europe as a raw material in the manufacture of linoleum. With this change in the character of gum, manufacturers are tending to substitute Chinese wood oil, just as in former years, when kauri was cheap, this gum appeared in the market as a substitute for gum anime, obtained mainly from Zanzibar.

AFRICA

The tropical forests of Africa contain a great variety of hard woods, but the inaccessibility of the forests and other customary difficulties of lumbering in the tropics render this region unimportant except for a few specialized kinds of timbers. The west coast areas produce a number of kinds of mahogany, obtained mostly from the French Ivory Coast, from the Gold Coast, and from southern Nigeria. As a rule, the African products are not of as fine a quality as those cut from the forests of Central America, but they have some compensating advantages, namely, they are easily worked; their price is relatively low; and most of the wood is well-figured. Ebony is a product of tropical east and west Africa.

North Africa contains a number of rather common varieties of trees, such as the ash and oak, and what is of more interest for general commerce, the cork oak which grows in Algeria, Tunis, Morocco, and in Portugal, Spain and southern France. The bark is thick and spongy. It is removed by making incisions in the tree, and then the slab is carefully removed so as not to injure the growth. The bark may be removed at periods of from six to ten years. The first stripping, made when the tree is about twenty years old, is rough and crumpled and is of little value, but the quality improves with successive harvests up to about the fiftieth year when it is the best, although the tree continues to yield for about a hundred years. After stripping the bark is left on the ground a few days to dry and is then carried to collecting points where further seasoning takes place, and the outer scale is then scraped off, and the cork is sorted and graded.

Industry has found many uses for the material. Because of its lightness it is used for buoys, life preservers, and floats for the fish nets. The optician uses cork strips to make eyeglasses more comfortable and fixed. Some twenty years ago large quantities were used for bicycle handles; the manufacturers of stoppers consume large quantities. It is cut into very thin cork paper which is used for cork-tipped cigarettes. A preparation of cork powder and linseed oil is spread on some durable fabric and pressed, and comes from the factory as linoleum. Table mats and pincushions sometimes contain the material, and it is often used as a nonconducting substance in water coolers and in cold-storage rooms. Substitutes are constantly being found for cork; but, on the other hand, new uses constantly make an appearance. Portugal is one of the largest producers. In 1924, the output was about 110,000 metric tons of which about 48,000 tons were imported into the United States.

THE FORESTS OF SOUTH AMERICA

We have already referred to the varieties of rubber as characteristic products of the Brazilian forests. The entire rubber area is estimated to cover more than 2,000,000 square miles, and to contain many million trees. Much of this region has never been explored and its real resources are unknown. The forests contain not only woods, but a vast variety of natural growth which supplies gums, resins, fibers, tanning materials, and medicinal plants.

Among the trees which yield other products than timber are coffee, cacao, yerba maté—which supplies the so-called Paraquay tea—and the quebracho of South Brazil, which is a source of a valuable tanning material. The carnauba palm supplies a product which resembles beeswax—obtained from the under portion of the leaf. Among other uses, it is consumed in the manufacture of shoe polish and candles. In 1925, the United States imported more than 4,000,000 pounds of this material. Many kinds of hard woods grow in the forests, but in most cases the supply is inaccessible, and even where timber is located on or near the streams, the lumber is too heavy to float to market. The domestic lumberman makes considerable use of the Parana pine, sometimes known as the candelabrum tree. The Brazil nut is a characteristic product. These nuts grow in hard pods, sometimes 15 or 20 to the pod. The harvest is obtained mostly from the states of Pará and Amazonas, and the product is sold at auction at the city of Pará or Manáos. Some 19,000,000 pounds were imported into the United States in 1926. Brazil produces also the souari or butternut; it is consumed at home, but as yet it has not become an export article. Brazil is a potential exporter of the coconut and its products; the tree grows in many parts of the country but thus far the fruit is exploited only for domestic use.

Argentine, also, has a supply of quebracho. It grows in the northern part of the country and from the commercial point of view is one of the most important products of her forests. The wood is extremely hard and durable, and resistant to the action of the elements. Railway ties and fence posts made of this timber are said to have a life of forty years. But foreigners who trade with Argentine are more interested in the tanning extract which the tree yields. In 1926, Argentine exported more than 446,000,000 pounds of this material, valued at $15,600,000. The resource has been developed largely by foreign capital.

The countries along the northwest coast of South America are potential producers of timber, but as yet, the timber areas are largely isolated from the outside world by lack of communication. Peru contains many valuable trees such as walnut, mahogany, satinwood, cedar, rosewood, and some cinchona. The forests of the Guianas are said to contain some three hundred varieties of trees including balata, red cedar, locust, and letterwood, and Venezuela contains rubber, coffee, balata, sarrapia, and copaiba.

The sarrapia tree, which bears the tonka bean, is found in several of the countries in the north of South America. The crop is obtained only once in four years. The product is used in the preparation of chewing tobacco to give flavor or aroma, and as a basis in the manufacture of perfumes. "The trees are almost altogether along the upper Orinoco and the Caura, and gathering of the beans is dangerous and difficult. The men go out in bands of 10 or 15. As they must take with them food supplies for two or three months, and as the forests are wet and hot, many die from fever and starvation."[6]

The tagua palm, the source of the ivory nut, or vegetable ivory, grows in several of the northern countries, notably in Colombia and Venezuela. This product is exported to Europe and to the United States and is used chiefly in the manufacture of buttons and ornamental objects. From six to nine nuts are contained in a single drupe or head. The nuts themselves are often as large as hen's eggs, and when prepared for use, if not examined too closely, might be taken for real ivory. Colombia and Ecuador sometimes export as much as 50,000,000 pounds of this product.

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[6] Special Agent Series, No. 81, p. 205.

It is evident from what has been said above that South America contains great undeveloped forest resources. In most cases, at present, the materials are simply taken from the forests and no effort has been made at cultivation. Because of the enormous resources this is not necessary, except as cultivation might make the supply more accessible, or improve the quality. Scattered throughout the continent are thousands of products which have no present use, but which in time will have great commercial value. Coconut palms are indigenous in many places, as in Venezuela and Brazil, but little or no effort has been made to develop industries based on this material. The mangrove bark is an acceptable tanning material, and it exists in great abundance, but it is produced only to a small extent; and this statement also applies to divi-divi, another tanning substance. Plants of the bamboo type are abundant in some sections but as yet they have no commercial use. Possibly the Panama hat, made from the paja toquilla, a tree which seems to thrive best in Manabi, Ecuador, requires too much painstaking labor to become an important article of export, and as yet we have no intimation whether machine industry could convert the fibers into acceptable headwear.

CENTRAL AMERICA

In this area coffee, bananas, and to some extent cacao are cultivated plants. But Central America produces a large number of valuable woods from the original forests. Most of this section contains mahogany, cedar, and rosewood. Nicaragua contains rather extensive supplies of pine, in addition to mahogany and rosewood. For many years the logwood industry was the mainstay of Honduras; but the industry has declined in recent years partly because of the substitution of synthetic for vegetable dyes, and partly because the accessible supplies have been largely depleted. Coconuts are produced in great numbers in Nicaragua. The Santa Maria, or calaba, which grows in a number of Central American regions, is a large evergreen which yields a hard elastic wood bearing some resemblance to hickory. The *guayacán* (*Tecoma chrysantha*) of Panama is a very hard and durable wood. When rafted, it must be floated on lighter timber, since it is heavier than water. The tree which produces balsam of Peru is exploited in a very limited area—only about 750 square miles—along the Pacific slope of Salvador. The tree is tapped during the dry season, yielding some 3 or 4 pounds of sap a year. The balsam is a "viscous, grayish red, semifluid mass, of pleasant odor not unlike vanilla, and bitter, burning taste." The prehistoric use seems to have been in primitive surgery in which its healing and antiseptic powers gave it great value. It is used today in the manufacture of ointments, salves, pomades, and face lotions, and it has been used in the treatment of tubercular cases.

MEXICO

The first-class timberland of Mexico covers upwards of 25,000,000 acres. At present, much of this supply is inaccessible, due to the lack of transportation. The timber includes several kinds of oak and pine, in addition to timber which is more or less peculiar to hot climates. The zapote family is represented by several varieties, including the zapote mamey, the source of chicle. The latex is, of course, a valuable article of commerce, but the timber itself may be used industrially. The wood is a deep reddish brown and is very hard, but it is easily worked until thoroughly seasoned, and then only the hardest edge tool can penetrate its surface. The Mexican forests also contain red cedar, used in the manufacture of lead pencils and cigar boxes. Mexico contains some twenty-five varieties of commercial hard woods, but these resources have been exploited only to a limited extent. The most plentiful supplies are on the Gulf of Mexico side of the Isthmus of Tehuantepec, mainly in the states of Vera Cruz, Tabasco, and Campeche.

UNITED STATES

The original forest resources of the United States probably covered 850,000,000 acres, with a stand of not less than 5,200,000,000,000 board feet, measured by present standards. The supply was included in five great regions: (a) the Northern, (b) the Southern, (c) the Central, (d) the Rocky Mountain, and (e) the Pacific.

White pine was one of the most important timbers of the Northern forest. With it grew red pine, spruce, hemlock, cedar, balsam, fir, and several varieties of hard woods. Before exploitation began, this area probably covered 150,000,000 acres containing about 1,000,000,000,000 board feet. The composition of the Central forests was principally hard woods of which the most important were oak, yellow poplar, elm, hickory, chestnut, red gum, ash, and walnut. This region covered 280,000,000 acres and contained about 1,400,000,000,000 board feet. The Rocky Mountain forests were coniferous; Western yellow pine was the most common tree, with lodgepole pine, larch, spruce, Western red cedar, Western white pine, and Douglas and other firs abounding locally. The area was about 110 million acres. The Pacific forests were chiefly of evergreens, with the following trees predominating: Douglas fir, Western yellow pine, redwood, Western red cedar, sugar pine, and several other firs, cedars, and spruces. This area covered about 90,000,000 acres. The Southern forests contained mainly yellow pine, with an intermingling of hard woods on the better soils, and cypress in the swamps. The area was about 220,000,000 acres.

Considering the extent of the original supply and the variety of timbers which the forests contained, this was the greatest timber resource of the world. One hundred years ago the supply seemed to be inexhaustible, as indeed it was, if it had been used only for commercial purposes. But enormous quantities of this timber were ruthlessly destroyed by farmers to make room for agriculture. This result was partly due to our too liberal land laws which encouraged the acquiring of farm land far beyond the agricultural needs of the country. But throughout its history lumbering has been a most wasteful industry, and much of the timber which passed into the hands of the lumberman might have been conserved by more careful systems of cutting, logging, and milling. Forest fires, due to the carelessness of campers, to lightning, and to sparks from locomotives, have destroyed many acres of virgin timber.

These losses and wastes added to the industrial uses have reduced the original supply to about 550,000,000 acres, with a probable stand of about 2,500,000,000,000 board feet. Measured in board feet, this is something less than half the original supply. Even this reduced amount seems to be ample, but it is not large in view of the enormous annual consumption. No doubt great areas are being "regenerated" by natural seeding, but no one seems to know the extent to which this process is going on. It could, however, be hastened so as to reclaim large areas by the rather simple and inexpensive methods applied in Sweden.

The largest reduction of timber supply has been in the Central States, and the least in the Rocky Mountain and Pacific areas. Much of the area in the central portion of the United States from which the forests have been removed is now used by the farmer, and it is needed for agricultural purposes. In recent years our forest policy has been discussed in connection with the control of floods, with the reclaiming of land along the watersheds of the streams, and this in turn has been connected in public discussions with an extensive system of waterway and land improvement.

The policy adopted by the United States has been to promote better forest use, and this work has been further promoted by the introduction of forestry courses in a number of the colleges. The forest work of the United States began in 1876 with the appointment of an agent serving in the Department of Agriculture. His principal duties were to study forest conditions. The Division of Forestry was created in 1881, but because of meager appropriations it was unable to do work of real value. The Bureau of Foresty was authorized in 1901, and this, under the terms of an act of 1905, became the Forest Service, under the jurisdiction of the Department of Agriculture. This service is now charged with the duty of administering the national forests, but in addition, it is required to study forest conditions, the best methods of utilizing forest resources, and the physical and mechanical properties of woods, and it is expected to collect information concerning the needs of the wood-using industries.

The policy of setting aside land as reserves for forest purpose was inaugurated under the terms of the Act of March 3, 1891. The President was authorized to set aside, from time to time, public lands containing forest trees. The area of national forests in 1927 was about 158,000,000 acres.

Department of Immigration of Canada

A stand of spruce in British Columbia

CANADA

This country contains one of the greatest sources of timber in the world. Exploitation has not been as rapid as in the United States, although in the last ten or twenty years the lumberman has begun to make great inroads in some sections. The wooded area covers approximately 285,000 square miles. Several hundred varieties of trees are contained in the Canadian forests, but the most important are pine, spruce, hemlock, oak, elm, maple, beech, birch, and hickory. British Columbia is supposed to contain one of the greatest compact reserves of timber in the world. One of the greatest present sources of demand for Canadian timber is in the manufacture of wood pulp. The United States affords an immense market for newsprint manufactured from Canadian materials. In 1927 the export of wood pulp was 846,000 tons. In that year the daily capacity of the Canadian mills was 7,350 tons of newsprint.

DYEWOODS

Dye materials obtained from trees and shrubs have largely lost their importance as articles of commerce because of the introduction of the coal-tar dyes. This is only one of numerous illustrations of changes which are constantly taking place in a progressive society. One of the most remarkable features of industrial development during the last hundred years has been the rapid shifting of the dependence of industry from one material to another due largely to the progress of invention and discovery. Stable conditions never exist in an advancing society, and stabilization is impossible as long as a society is in the throes of progress. This may seem to be heresy to those who proclaim the doctrine of stabilization, but every great invention and discovery bears testimony to the truth of the statement we have just made. The discovery of aniline dyes is only one illustration.

For centuries indigo and madder were basic materials in the art of dyeing. Indigo, as the name indicates, was once supplied from India, but in later years the industry spread to many parts of the world. At one time considerable quantities were produced in the United States. The production of madder, the source of turkey red, was also widely distributed. In the course of time other vegetable dyes were added. Logwood supplied blues and blacks, Brazilwood supplied red, fustic yielded yellow, and cutch supplied a brown color. As long as industry depended on vegetable dyestuffs the range of colors was very limited. The aniline dyes have added enormously to color varieties, practically every shade which the eye can detect. In fact, the substitutes serve the wants of people much more completely than the original vegetable materials.

QUESTIONS

1. What are the sources of waste in lumbering? How much of this waste could be prevented?
2. Give an estimate of the present timber supply of the world. What areas are best supplied?
3. Why are not tropical forests as dependable sources of timber as those in the temperate areas?
4. Discuss the forest policy of Sweden.
5. What investment problems are involved in systematic timber growing of private companies?
6. What are the chief timber products of southern Asia, and to what uses are they put?
7. What are the typical forest products of the various regions of the world?
8. What forest policy would you advise for the United States?
9. Are there adequate substitutes for timber—if so what substitutes?
10. What are the chief forest problems of the future?

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PART III

RESOURCES AND DEVELOPMENT OF CERTAIN COUNTRIES

CHAPTER XXIV

RESOURCES AND DEVELOPMENT OF THE UNITED STATES AND CANADA

The economic organization of the United States is much better balanced than that of any other country. This organization contains all the great divisions of economic activity, including (*a*) various kinds of raw material producing industries, (*b*) a well-developed commercial organization, (*c*) diversified manufactures, and (*d*) business professional talent trained for service in industry. These divisions and their many subordinate parts work with as much harmony as is possible in any economic system to promote the aims of the organization, namely, the satisfaction of human wants.

A PERFECT BALANCE UNATTAINABLE

Since there has been so much discussion, particularly within the last decade, about a balanced industry, it may be well to devote a little thought to this condition. It may be said at the outset that a perfect balance is unattainable. A number of strong operating forces work against such a balance. In the first place, no country contains all the resources necessary for its development. The United States most nearly approximates this ideal, but we fall short in some notable respects. This country produces very little platinum, nickel, and tungsten; we produce no silk, coffee, rubber. And even in the case of some of our greatest resources, the time may come when we will be compelled to look beyond our borders for large additional supplies, as with petroleum. Moreover, we must import tropical products, and we depend on foreign manufactures for those commodities which we do not possess the talent or skill to produce. Nature has distributed her resources very unequally over the surface of the earth; and thus, by the very nature of the case, a national economic balance is impossible.

But such a balance is unattainable for other reasons. No nation produces even the approximate quantities of merchandise or raw materials which its people and industries consume. Foreign markets are necessary to consume the surplus; and import is necessary to supply what the nation cannot produce. If a nation buys abroad it must find means of payment, and this must be by the export of goods, or by rendering some kind of service, to foreign consumers; this latter includes all those items which enter into the invisible balance of trade.

But there is still another reason why a balance cannot be attained. The results of invention and discovery not only alter relations of industries within countries, but among the countries, To give only one illustration—the discovery of the new world caused a shift in all the old commercial relations. Hundreds of historical examples could be given as proof of this point. Economic progress is constantly destroying old balances and building up others temporarily, which will shortly give place to still others. A balanced economic organization is one in which progress has come to an end. The real task of a progressive economic society is to learn how to make the readjustments made necessary by progress with as little loss as possible.

RESOURCES OF THE UNITED STATES

The year 1880 marks the approximate turning point in the United States from relatively small industries to production on a large scale. And by the same token, it marks the beginning of rapid exploitation of natural resources. The production of bituminous coal, for example, increased from 42,800,000 tons in 1880 to 578,200,000 in 1926; of petroleum from 26,200,000 barrels in 1880 to 766,500,000 barrels in 1926; and of copper from 60,400,000 pounds at the former date to 2,322,000,000 pounds at the latter. In most important cases, because of the prolific nature of the resources, this country is much more than self-sustaining. In 1926 the United States produced approximately 25 per cent of the total world wheat supply, 65 per cent of the corn, 40 per cent of the tobacco, 60 per cent of the cotton, 42 per cent of the coal, 70 per cent of the petroleum, 50 per cent of the iron ore, and 54 per cent of the copper. We produced no silk or rubber, and only small proportions of some of the minor metals. In the resources of fields and forests, and of mines and quarries, the United States is in a specially favored position.

GROWTH OF CAPITAL

The development of these resources has required ever increasing supplies of capital in the form not only of tools and machines but of liquid funds. In 1925 the investment in manufacturing enterprises, in railways, mines and quarries, and farm equipment amounted to nearly $70,000,000,000. In some cases this was a remarkable increase over the investment of sixty-five years ago. The growth of manufacturing capital, for example, was more than fortyfold, increasing more rapidly than national wealth, which was only twentyfold from 1860 to 1922. In fact, the wealth has increased so rapidly that the people of the United States have been lending large amounts abroad, particularly in the last six or eight years. This matter has been discussed in one of our early chapters.

ESTIMATED NATIONAL WEALTH OF THE UNITED STATES, 1922

Form of Wealth	*Amount*
Real property taxed	$155,909,000,000
Real property exempt	20,506,000,000
Livestock	5,807,000,000
Farm implements and machinery	2,605,000,000
Gold and silver coin and bullion	4,278,000,000
Manufacturing machinery, tools, etc.	15,783,000,000
Railroads and their equipment	19,951,000,000
Motor vehicles	4,567,000,000
Transportation and transmission enterprises, except railroads	15,414,000,000
All others, including the products of agriculture and manufacture, imported goods, furniture, clothing, and personal effects	75,984,000,000
TOTAL	$320,804,000,000

The total national wealth of the United States in 1922 was estimated at $320,000,000,000. The approximate distribution of this amount is given in the table on page 477.

AMERICAN INDUSTRIAL POLICY

The enormous expansion of our wealth-producing power is the result not only of the growth of the mechanical means of production, but of numbers which have caused a great increase both of producing and of consuming power. The per capita producing power in the United States is much higher than in any other country in the world—in some cases two or three times greater—and this means directly great consuming or saving power, or both.

The features of our industrial system which seem to impress foreign investigators are the following:

(*a*) Promotion is by merit.

(*b*) The application of the principle of a small rate of profit on each turnover, although the investigators observe that there are some exceptions to this rule.

(*c*) The securing of rapid turnover by the simplification of manufacturing and mercantile processes which results in a smaller capital outlay for a given amount of production.

(*d*) Keenness in devising time-saving and trouble-saving devices.

(*e*) The elimination of waste, which involves not only the introduction of by-product industries, but the saving of the wastes of time, energy, and industrial space.

(*f*) The payment of high wages for effective performance of work.

(*g*) The exchange of commercial and technical information among producers, and the introduction of systems of research applying not only to selling, but to cost and other technical problems in the factory.

(*h*) And finally, the welfare methods which tend to increase the productivity of the workers by surrounding them with wholesome working conditions, such as cleanness and light, and various conveniences which make conditions in the factories and stores more tolerable.

There is no question about the correctness of this analysis. Industrial research has become almost a fetish among the larger manufacturers. And this involves the employment of trained chemists, engineers, and economists who are able to give accurate information and to supply new ideas. Tradition plays very little part in the management of many business enterprises—a condition which characterizes American business methods, as distinguished from those in most European countries. A machine, or an industrial method, is promptly discarded when another has been shown to be more effective. One great feature of manufacturing development in this country has been the introduction of by-product, or related-product, industries. This system has several advantages, but not the least important are the conversion of useless waste into valuable commercial materials, and the diversification of industry under a given management so that company income has become more stable. The type of integration which brings together related lines of industry—the most recent kind of combination in the United States—produces the same results, namely, it gives greater stability to income.

GROWTH OF POPULATION

As indicated above, a growth in population usually signifies, in a progressive country at least, the development of both producing and consuming power. It is difficult to decide which is cause and which is effect. But, to a large extent, it is no doubt true that an increase in producing power makes possible an expansion of population, although there is truth in the other side of the proposition. The fact of the matter is that a growing industry and a growing population react on each other.

The population of the United States increased a little more than three times from 1860 to 1920, the numbers at the latter date being 105,700,000. This increase has been aided materially by the liberal immigration policy of the country which prevailed until the passage of the Act of 1921, which put immigration on the quota basis, limiting the inflow to 3 per cent annually of the people from foreign countries resident in the United States in 1910. By the subsequent Act of 1924 the quota was reduced to 2 per cent, and 1890 was made the year for the calculation of the quota. From 1860 to 1920 about 28,000,000 immigrants were admitted to this country. But, on the other hand, there has been a very considerable emigration during these years, amounting to about 30 per cent of the immigration.

Immigration has made an important contribution to the industrial growth of the country not only by adding to the number of workers, but by greatly enlarging domestic consumption. There is no question about the value of the skilled immigrant who brings new and valuable information about some trade, and who adds to the prosperity of the country because of his skill. But the unskilled man, also, has contributed valuable labor service. Such men have helped to build railroads, to improve highways, and they have supplied labor to farms, mines, and factories. Many of our natural resources have been largely developed by immigrant labor. This could readily be shown by a study of the foreigners engaged in farming, mining, and forestry during the past fifty years. The tendency of native laborers, and of the older immigrants and their children, to rise to the class of skilled workers, has left a vacuum at the bottom. For many years the immigrant has been needed to fill this void.

It is a debatable question whether this country needs such extensive immigration as in past years. There are some indications that we have at home a large reserve of labor. For one thing, the increase in industrial efficiency, and the growing use of power and other labor-saving devices, diminish somewhat the labor requirement. In addition, some industries—and coal mining is a notable case—are overmanned. The increasing effectiveness of farm machinery, also, releases annually a considerable number of men from the agricultural branches. And in addition, there is now a large normal rate of increase of population. The saving of labor waste and the increase of the efficiency of work contributed also to the available labor force.

THE AMERICAN MARKET

The freedom of the domestic market has always been one of the great advantages which America has possessed compared with other countries. Trade in European countries is hampered by the presence of fifteen or more tariff boundaries. Import duties are sometimes prohibitive; in all cases they add greatly to the cost of distributing goods, and they are an item of no little importance in the cost of living of the people. But they affect production in a less obvious way. They frequently force capital into industries in which the countries have little or no advantage. Both people and countries would be much better off if greater reliance was put upon imported articles. But national rivalries, the desire for self-sufficiency, and at times tariff wars prevent the countries from adopting a freer trade policy. Some relief is obtained from these restrictions through the formation of international cartels.[1]

Trade flows throughout the United States, however, without restriction. Although this country has built up an extensive system of regulation, particularly since 1887, applying to railroads, combinations of business, and to such of the banking as is carried on under federal laws, there are no duties laid on internal commerce, nor can such duties be imposed, according to our constitution. This condition has given the nation the greatest unhampered, or free market, of any country in the world. Industries may be found at places where economic conditions are suitable. Great attention can be given to the principles of industrial localization, since there are no tariffs to interfere with the operation of these principles. Industries tend to be localized at places where production and distribution costs are least, and this is one of the conditions which makes possible a low cost of production.

But in the external trade the United States has applied the principles of protection, although during the twenty years before 1860, the rates were relatively low, and the Walker tariff of 1846 nearly established the country on a free-trade basis. Tariff changes made necessary by the financial arrangements of the Civil War period placed the country on a high protective basis, and this system has been continued with slight interruptions since that time. The tariff has frequently been a national issue and rates have been changed on a number of occasions. The United States is now operating under the Fordney Act of 1922. Notwithstanding the protective tariff, a surprisingly large proportion of the total imports pay no duty. In term of value, 64.4 per cent of the imports in 1926 were imported free.

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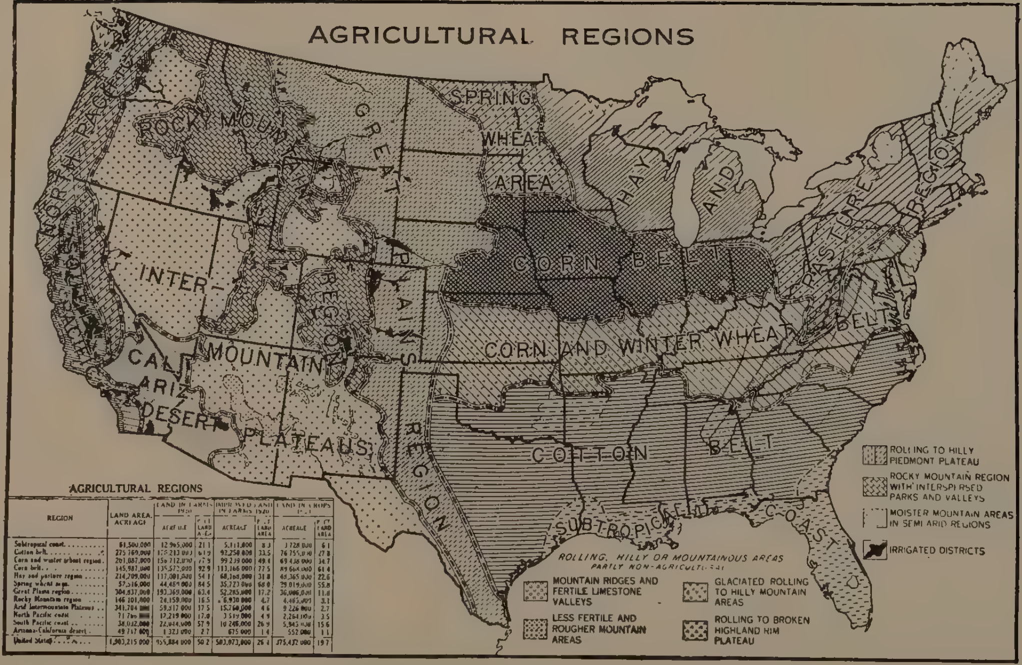
[1] See Chapter III.


AGRICULTURAL REGIONS
SPRING WHEAT AREA
HAY AND PASTURE REGION
CORN BELT
CORN AND WINTER WHEAT BELT
COTTON BELT
SUBTROPICAL COAST
GREAT PLAINS REGION
ROCKY MOUNTAIN REGION
INTER-MOUNTAIN PLATEAUS
NORTH PACIFIC
SOUTH PACIFIC
CAL ARIZ DESERT
ROLLING TO HILLY PIEDMONT PLATEAU
ROCKY MOUNTAIN REGION WITH INTERSPERSED PARKS AND VALLEYS
MOISTER MOUNTAIN AREAS IN SEMI ARID REGIONS
IRRIGATED DISTRICTS
ROLLING, HILLY OR MOUNTAINOUS AREAS PARTLY NON-AGRICULTURAL
MOUNTAIN RIDGES AND FERTILE LIMESTONE VALLEYS
GLACIATED ROLLING TO HILLY MOUNTAIN AREAS
LESS FERTILE AND ROUGHER MOUNTAIN AREAS
ROLLING TO BROKEN HIGHLAND RIM PLATEAU

AGRICULTURAL REGIONS

REGION	LAND AREA, ACREAGE	LAND IN FARMS 1920		IMPROVED LAND IN FARMS 1920		LAND IN CROPS 1919	
		ACREAGE	PER CENT LAND AREA	ACREAGE	PER CENT LAND AREA	ACREAGE	PER CENT LAND AREA
Subtropical coast	61,500,000	12,965,000	21.1	5,111,000	8.3	3,728,000	6.1
Cotton belt	275,769,000	170,213,000	61.9	92,250,000	33.5	76,755,000	27.8
Corn and winter wheat region	201,087,000	156,712,000	77.9	99,239,000	49.4	69,438,000	34.7
Corn belt	145,987,000	135,572,000	92.9	113,166,000	77.5	89,664,000	61.4
Hay and pasture region	214,709,000	117,001,000	54.1	68,165,000	31.8	48,365,000	22.6
Spring wheat area	52,516,000	44,459,000	84.5	35,723,000	68.0	29,019,000	55.3
Great Plains region	304,837,000	193,369,000	63.4	52,285,000	17.2	36,086,000	11.8
Rocky Mountain region	146,101,000	24,159,000	16.5	6,930,000	4.7	4,465,000	3.1
Arid Intermountain Plateaus	341,704,[illegible]	59,517,000	17.5	15,760,000	4.6	9,226,000	2.7
North Pacific coast	71,786,[illegible]	12,219,000	17.0	3,519,000	4.9	2,264,000	3.5
South Pacific coast	38,032,000	22,044,000	57.9	10,246,000	26.9	5,945,000	15.6
Arizona-California desert	49,717,000	1,323,000	2.7	675,000	1.4	552,000	1.1
United States	1,903,215,000	955,884,000	50.2	503,073,000	26.4	375,432,000	19.7

Agricultural regions of the United States

AMERICAN AGRICULTURE

The soil is one of our greatest resources. The great diversity of soil and climatic conditions make possible a varied agriculture. The annual corn crop frequently exceeds 2 billion bushels; production of wheat is often in excess of 900 million bushels, and of oats more than a billion bushels. During the decade ending with 1875 the average annual production of potatoes was about 167,000,000 bushels; but in the last decade it averaged about 400,000,000 bushels a year. Cotton, the staple crop of the southern states, has increased from an annual average of 3,200,000 bales in the decade ending with 1875 to an average of about 12,000,000 bales for the last ten years, although in certain years the output has been much greater, as in 1926 when production was 17,000,000 bales. This large production not only supplies our own mills but contributes largely to the cotton-spinning industry of Europe. Our field resources contribute to our food and manufacturing needs in another way, namely, by sustaining a large animal industry. In 1927 there were on the American farm 57,000,000 cattle, 41,000,000 sheep, and 52,000,000 swine. The production of fruits has more than kept pace with the needs of domestic consumption, and the same is true of the production of vegetables.

In agriculture, as in mining and forestry, our resources not only provide for most of our domestic needs, but provide a large surplus for consumption in other countries. Our large exports of cotton, wheat, flour, animal oils and fats, fruits and nuts, and tobacco bear witness to this statement. The aggregate value of the exports of the items just named was $1,700,000,000 in 1926. This is a part of our contribution to the food and manufacturing needs of other nations.

American farming began to emerge from pioneer conditions in the decade from 1830 to 1840. Prior to this time most of the farm work was done by hand, and traditional methods were the only guide for the farmer. By 1860 mowing, reaping, threshing, and plowing were performed to a considerable extent by mechanical methods. Although the Whitney cotton gin, invented in 1793, was not an agricultural device, it supplied an enormous stimulus to southern farming by making cotton a commercial crop.

Since 1900, American agriculture has been experiencing a new revolution. The main features of this era are the application of business methods to agriculture, the employment of trained service in the farming industries, and the further application of mechanical methods. A significant feature of this most recent period is the great interest in agricultural education.

The extent to which men and women are availing themselves of this type of education is shown by the fact that in 1920 there were 31,000 students in agricultural schools, while the number in 1926 was 108,000. No one can doubt that this increase in the supply of trained men is transforming the business of farming. This training performs the same function for management of farms as the new machinery does for actual mechanical production.

The question is sometimes asked whether these changes signify that capitalistic methods will dominate the farming business, and whether the small farmer will be driven out of existence. The answer is in the negative. The average size of farms, as shown in the decennial Census reports, has fluctuated between 136 acres, the average in 1890, and 148 acres, the average in 1920. But a detail study of the returns shows that in some sections farms are much smaller than the average, and that in many cases these small farms are profitable enterprises. In fact, the size of a farm and the kind of equipment with which it can be economically operated, depend upon a number of factors including the human, the technical, and the market. Size depends partly on the kind of crop, partly on the distance from the market, partly on climate and topography. To a large extent, the magnitude of operations depends on the opportunities which the particular farming enterprise offers for division of labor and supervision of men. The problem of superintendence is much more difficult than in manufacturing industries where men are crowded closely together in the departments of the establishment.

Nor is this the whole story. The seasonal nature of farming renders it almost impossible to maintain a working organization throughout the year. Farm management, therefore, in the vast majority of cases, becomes a matter of close personal supervision by the owner, or by the owner in coöperation with laborers or tenants. These conditions are enough to make farming largely a matter of individual ownership.

Throughout our history, farmers have been periodically beset by periods of unrest. This was notably the case in the period from 1870 to 1900 and again in the years from 1922 to 1928. In the earlier period the farmers sought relief through money legislation with the expectation that an increase in the quantity of money in circulation would bring higher prices and relieve distress. About 1870 the demand was for more paper money to be issued by the government, and from about 1878 to 1900 the proposed remedy was the free and unlimited coinage of silver. Since 1922 farmers' representatives have based the proposed reforms on the control of the market, somewhat after the fashion of the pooling and combination arrangements which have existed in certain large manufacturing industries, and which existed on an international scale in the form of cartels, and in the control of such commodities as coffee, rubber, nitrates, and tanning materials, among others.

One important reason for the troubles of many farmers is that there is an excess of producing capacity, that is, of land devoted to wheat, cotton, and livestock; this refers not only to the land within the United States, but in the world. In former chapters we have seen that there are still great undeveloped areas. A rise of price of the basic farm commodities stimulates further production not only in this country but elsewhere. Another reason for the farmers' troubles is that there is severe competition within the farming industries. In the case of any particular crop, there are great differences in cost of production, and producers in the low-cost ranges have a great advantage over those in the upper ranges. It is doubtful whether the markets for basic agricultural products can be controlled or regularized. Even in manufacturing and merchandising, where the problem is rather simple, compared with that of agriculture, combinations for the purpose of regularizing markets and maintaining prices have met with only limited success, and at that, only for a short period. Stabilization, in a progressive society, cannot be main-

The Highland Park plant of the Ford Motor Company tained for any length of time for the reason that discoveries, improvements, and inventions are continually throwing the old relations out of balance.

MANUFACTURING INDUSTRIES

Wide diversification of industry is one of the great features of the American economic organization. This is partly the result of the varied nature of resources, but it is partly the outcome of a high degree of specialization and of the multiplication of industries through the use of waste products. Industrial research also contributes to the development of varied industries.

For purposes of classification, the Federal Census divided all manufacturing enterprises into sixteen major groups, such as food and kindred products, textiles, iron and steel industries, metals other than iron and steel, and the chemical industries. But an examination of the Census returns reveals hundreds of different industries. Great progress was made after 1820 in the introduction of the factory system; but the era of most rapid expansion has been since 1880. The prior period, before 1880, may be looked upon as an era of preparation in which the essential features were the development of an effective economic organization, the accumulation of capital, and the development of means of communication. Thus the stage was set for the period of phenomenal expansion which we have witnessed in the last forty years.

The great industries of today were only in a formative stage at the former date. This applies to petroleum and related products, tobacco, copper, iron and steel, and chemicals. Some industries which are at present in the front rank had scarcely made an appearance. The automobile business did not exist. The manufactures of aluminum, of cement, and of electrical products, to give only a few examples, were only in the nascent stage. The total amount of capital invested in American manufactures in 1880 was less than $3,000,000,000; in 1920 it was more than $44,000,000,000; the value of the manufactured product at the former date was a little more than $5,00,000,000. In 1920 it was more than $62,000,000,000; it was about the same amount in

1925. More than three times as many wage workers are employed in manufactures today as in 1880.

Although manufacturing is widely diffused over the country most of the industry is concentrated in four regions. The most important is in a relatively small area extending from northeastern Massachusetts to northern Delaware. This is the region of densest population and of greatest labor supply. It is the greatest market in the country; this whole district is supplied with splendid transportation and other marketing facilities. Some of the old industries of this section are maintained because of the momentum of an early start, but in some cases, as is notably the case with the cotton textiles, this factor is losing its force, and many of the enterprises are moving to the South.

A second great area stretches along the Great Lakes, roughly from Buffalo to Chicago. One of the leading branches of industry along the eastern end of this region is the manufacture of iron and steel. Production of automobiles is largely concentrated in the Detroit area. Chicago is the great center of the meat-packing industry; this city is also the most important distribution point for manufactures destined for consumption among the agricultural regions of the West. A third region stretches along the Ohio River, roughly from Pittsburgh to Louisville, and the fourth and newest region comprehends portions of northern Alabama and sections in Georgia and the Carolinas where the production of iron and steel and cotton textiles has become important in industry.

With the growth of manufactures there has been a corresponding increase in the draft upon natural resources. In fact, this tax has become so great that many persons have expressed the fear that in some cases the natural supply cannot sustain, for any considerable length of time, the present rate of increase in demand. It is true that unless discovery reveals new resources, or unless inventions find substitutes, both industries and final consumers will be forced to greater economies, or at least, to more economic uses of both raw and finished products. The drain upon such materials as iron, petroleum, copper, and timber is enormous. Some of the minor metals do not exist in unlimited abundance and consumption is already a tax on the better grades of materials. The field industries are in a more favored position because there are still important areas which have not been exploited; and, moreover, the output from present sources can be greatly increased by improving the methods of production.

FOREIGN TRADE

Until about 1860 the export commerce of the United States revealed one common feature of foreign trade of all new countries, namely, the preëminent importance of one or two commodities. For many years cotton was our most important export. In 1810 the material constituted about 22 per cent of the value of the total exports. It rose to about 32 per cent in 1820, to 41 per cent in 1830, and to a little over 57 per cent in 1860. Notwithstanding the enormous quantities of other exports, the value of exported cotton in 1926 was about 17 per cent of the total. In recent years, with the growing diversity of our exports, and with the rise in importance of other commodities, our export trade is no longer dominated by one or two products.

In addition to cotton the most important exports today include petroleum and its products; machinery and vehicles of many descriptions; metals and their manufactures, including large quantities of copper, lead, and zinc; grain and its preparations; meat products, tobacco and its manufactures; lumber; coal; chemicals; fruits; and nuts. But the export commerce includes also a vast number of items, some of which do not have great value as individual commodities, but which in the aggregate represent a large value. Since 1898 manufactured commodities have been rising in importance in the export trade; in addition to ordinary articles this group comprises a large number of goods which are more or less peculiar to American skill and ingenuity, such as adding machines, typewriters, washing machines, phonographs, and office furniture, to name only a few of this class.

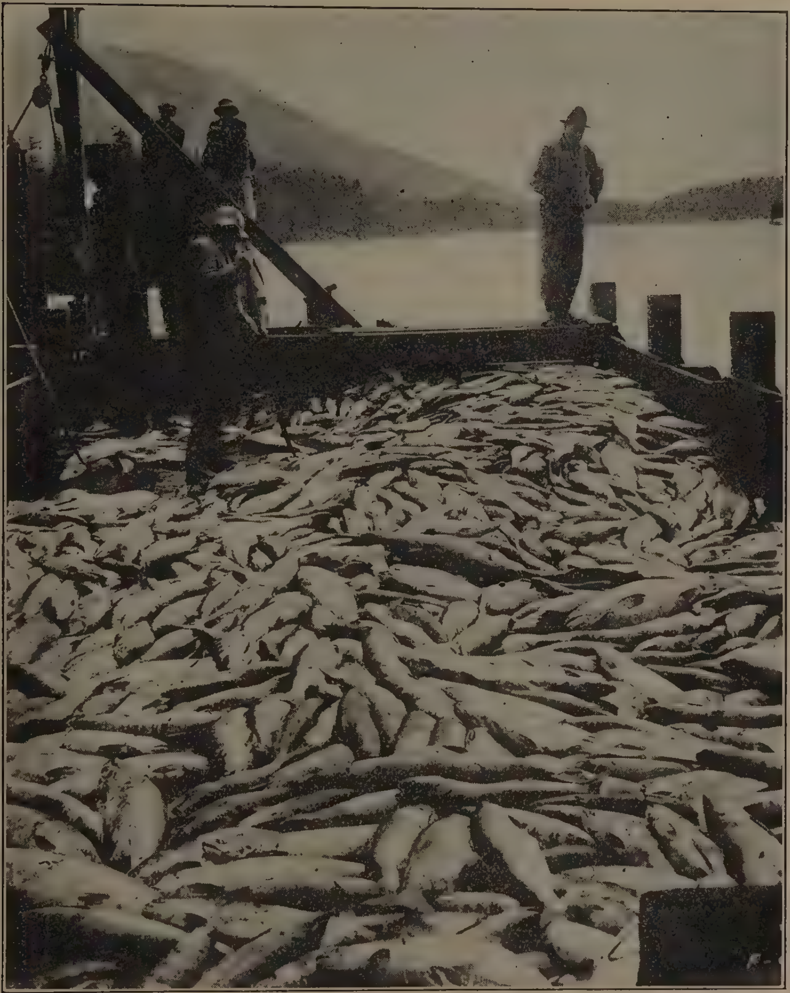
In fact, during the last thirty years, the character of our foreign trade has been changing, the significant features being the growing importance of manufactures as exported commodities, and the rise in importance of foreign materials in our import trade. If for no other reason, the latter change has been made necessary by specialization in industry which promotes a search of the world for adaptable raw materials, and by the appearance of certain new industries, as for example, the manufactures of rubber, which require materials which are not produced within our own borders. Nearly one-third of our imports is made up of commodities which we do not produce, such as coffee, tea, and cacao ($398,000,000), rubber and its manufactures ($515,000,000), jute ($113,000,000), and silk ($402,000,000). In addition, we are a large importer of sugar and related products, wool, paper, petroleum and copper, and a large quantity of textile manufactures ($999,000,000). The imports also include a vast number of articles of relatively small value but which in the aggregate represent a large sum, and this list comprises such commodities as precious stones and metals, fibers, gums, medicinal plants, dyestuffs, and manufactures which are the product of the taste and skill of the peoples of many regions of the earth.

The total foreign commerce has been rising steadily. In 1860 exports and imports combined amounted to $687,000,000; in 1900 to $2,244,000,000, and in 1926 to $9,240,000,000.

RESOURCES AND INDUSTRIES OF CANADA

The Dominion of Canada covers about 3,729,000 square miles, an area more extensive than that of continental United States including Alaska (3,617,000 square miles). A large part of the Canadian area, however, is unproductive, particularly the portion which extends into the arctic and subarctic regions. But a broad belt of farming and timber land extends almost across the country from ocean to ocean. The timber area which covers from 500,000,000 to 600,000,000 acres is one of the most extensive resources of its kind in the world. This resource supplies not only timber for export, but the raw material for pulp and paper.

Canada possesses, also, valuable mineral resources. The nickel-copper mines of Sudbury are the principal world source of nickel. Recent discoveries have revealed large deposits of copper. The



Ewing Galloway

A salmon catch on the Skeena River, British Columbia

gold mines of Porcupine are important sources, and the yellow metal is also mined in British Columbia. Resources of Quebec yield most of the asbestos of the world. Alberta, Nova Scotia, and British Columbia contain coal deposits. The fur industry is still an important enterprise of the Dominion although it is of declining importance. Fur farming has been tried successfully both in Canada and the United States. The fisheries include mainly the large annual catch of salmon, halibut, herring, cod, and lobster. Canada is one of the great surplus wheat-producing regions, this export in 1926-1927 amounting to nearly 30 per cent of the total foreign shipments. Canada ships bacon and hams to England; milk and cheese are among the agricultural exports.

Of necessity the growth of population has been slow. Until recent years a large portion of the country has been inaccessible for the immigrant, and much more so for commercial development. Settlement of the middle provinces had to await the occupation of the better farming lands in north central United States. For this region the central part of Canada has been a kind of frontier. In 1871 there were scarcely 50,000 people in Manitoba, Saskatchewan, and Alberta. This area now contains about 2,000,000 of the 9,300,000 population of the Dominion.

In recent years railway development has opened this country for settlement. In 1913 Canada contained only 29,000 miles of railway. This was increased to 40,300 miles in 1925. In some respects Canadian railway history resembles that of the United States. In many instances, when the railway era was inaugurated in this country, private capital would not take the risks of railway building, at least as rapidly as people and states demanded transportation. It was necessary, therefore, for some of the states to undertake the work, and even the federal government aided railway building by land grants and in some cases by guaranty bonds. In Canada, as in the United States, it has been necessary to build much of the mileage in advance of settlement and this task has fallen to the government. At present, about half the mileage is operated by the Canadian government—known as the Canadian National Railway System.

The opportunities for the development of resources are so great that domestic capital cannot be supplied rapidly enough, and much of the task of developing resources has fallen on foreign capital. During the last fifteen years large amounts of capital from the United States have been invested in Canadian railways, mines, public utilities, and forest and power development. Some $2,800,000,000 were invested in this way up to 1927, and the total foreign investment in the Dominion was estimated at $5,200,000,000. Capitalists of the United Kingdom have also invested large amounts in Canada.

In addition to great forest and field resources, the country contains vast undeveloped power facilities. Present production from mines includes gold, silver, nickel, cobalt, copper, lead, zinc, asbestos, mica, and gypsum. Production of petroleum in 1926 was 364,000 barrels.

The total export trade of Canada in 1924 was about a billion dollars. Products from forest and field industries made up over 70 per cent of the foreign shipments; wheat, flour, wood, both manufactured and unmanufactured, paper, pulpwood, and wood pulp were the leading items. The United States is the largest factor in the foreign trade of Canada. In 1927 imports into that country from the United States were 66 per cent of the total, and we received 37 per cent of Canadian exports. The United Kingdom was the next most important factor; although exports to this country are about equal to those to the United States, imports from the United Kingdom in 1927 were only 23 per cent of those from the United States.

QUESTIONS

1. Name and discuss the chief causes of economic progress in the United States.
2. To what extent are balanced conditions in industry possible? What conditions disturb the balances?
3. Do you agree with the statement that a "balanced economic organization is one in which progress has come to an end"?
4. Does the following quotation state the problem of a progressive society correctly? "The real task of a progressive economic society is to learn how to make the readjustments made necessary by progress with as little loss as possible."
5. Do you think that the most recent phase of industrial progress began about 1880? What is the evidence?
6. To what extent is the United States self-sustaining with respect to industrial raw materials?
7. Outline and discuss the essential features of the American industrial policy.

8. What evidence can you give for the statement that the United States does not have as large immigration as in former years? Do you think the present restriction laws are wise?

9. Contrast the American market with that of Europe as a whole. What advantages do you see in our favor?

10. Trace the development of American agriculture. When did surplus or overproduction become an important problem? In 1820? In 1880? In 1920? Why?

11. Do you think that the market can be stabilized for basic agricultural products? Why?

12. Where are the great market areas of the United States? What are the leading characteristics of each?

13. What changes have taken place in the character of our foreign trade in the last 40 years? Account for these changes.

14. Outline the leading resources and industries of Canada.

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CHAPTER XXV

RESOURCES AND DEVELOPMENT OF LATIN AMERICA

Although some of the earliest settlements in Latin America antedate the oldest permanent foundations in what is now the United States by almost one hundred years, the orderly economic development of these countries had scarcely begun until forty years ago, and even today, in some countries, there is only the merest beginning of a modern economic system.

CAUSES FOR THE TARDY GROWTH

The repressive colonial system of Spain, which prevailed until the struggle for independence began—in the decade from 1800 to 1810—may have had something to do with this backwardness, but after all, this was only a minor factor. Except for the precious metals, Latin America produced little or nothing that the outside world needed, and the economic requirements of the small population were not such as to promote the development of wealth and industry. Moreover, after independence, the long-continued political disturbances prevented the appearance of an orderly economic system. Not until the people of a few of the nations settled down to peaceful living was it possible to give serious attention to industry. Political turmoil discouraged the investment of foreign capital, and all Latin America needed this assistance because the countries were not developing industries themselves, nor were they accumulating funds for investment.

The general attitude toward work and toward industry and wealth retarded the economic growth. Latin Americans have looked with scorn upon what they call North American plutocracy. This probably means, not so much antipathy to wealth as such, as to the toilsome methods of labor and accumulation, and much more, the idealization of wealth as an important goal in life. Cultural attainments—appreciation of literature, oratory, the painter's art, architecture, and possibly statecraft—are more largely the ideals of these people than great wealth, which reveals some repulsive features.

This signifies that certain social values of Latin Americans are at variance with those of the people north of the Rio Grande. We can have no quarrel with the standards which people set up for emulation and direction, but we can indicate which personal or national characteristics lead to the foundation and growth of economic systems, and which do not. Judgment as to the relative importance of these social values rests with the nations themselves, and there is no final arbiter.

There can be no doubt that wealth is produced only by labor and effort; that economic advancement is attained only by producing an excess over present consumption, and by investment of this surplus in means for further improving facilities for production and saving. A good thing may be overdone, and there is a danger in putting too much emphasis on thrift, labor, and enterprise; but there can be no question that an endowment of these qualities is the reason for industrial progress. To these must be added the spirit of coöperation, whether in political or economic matters.

Latin Americans have been charged with an excess of individualism, and it has been urged that this characteristic is one of the causes for their economic backwardness. The strong sense of individualism lies at the basis of the many political struggles —particularly in the unwillingness to accept defeat gracefully— and this in turn, because it creates political uncertainty, is an economic handicap. The great republics of the far south—Argentine, Brazil, and Chile, have now attained to a high degree of political stability, and it is here that economic development has been the most pronounced.

Someone has said that the disposition towards revolution varies with the distance from the equator; it is true that political stability is greatest in the temperate regions, but orderly politics depends on other things than temperature and humidity. The racial complex in a particular region, the state of education, and political traditions, are the dominant factors, and these, in many regions, are the chief causes for political unrest.

Moreover, the attitude towards work has been a handicap in the development of wealth. As a rule, the Indians are willing workers and the burden of manual labor is borne without complaint. The immigrants into Brazil, Argentine, and Chile perform a large amount of the menial labor; in this respect immigration has been a great boon. Brazil, Argentine, and Chile, and some other countries, have actively encouraged immigration with the result, that in the first three countries named, there is a considerable supply of European labor. But the ruling classes, as a rule, are not disposed to work. It has been said that "in Peru the people would starve were it not for the Indians, who, having no false pride concerning manual work, are both industrious and effective as agriculturalists. It is true that the Spanish Americans have inherited, along with a mild scorn for industry, some of the indolence characteristic of the Spaniard, and there is no doubt that these characteristics have been deterrent elements in the Latin-American civilization."[1]

Such statements, of course, need modification. In all countries certain elements of the population engage in the shop trades and in merchandising, and the large land owners in Brazil and Argentine operate their estates for a profit and exercise at least general supervision over the business. Personal characteristics vary somewhat from country to country, although certain general features describe the whole continent. Of Colombia, Enock says:

> Nearly all the privileges and power to civic rule and political domination are in the hands of the upper class, but the social barriers between them and the mestizo class are not nearly as strong as in Ecuador and Chile. This upper class has very literally followed the old Spanish mandate that the white colonist should not engage in manual labor . . . all such work being delegated to the mestizos and Indians. Colombian society is thus very strongly divided into an aristocratic and serving class. The mestizo people have sturdy patient qualities which they inherit from the Indian side of their parentage; and as elsewhere in the Andean republics, they constitute the artisan and shopkeeper class and fill the

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[1] C. S. Cooper, *Latin America—Men and Markets,* p. 17.

positions of servants and day laborers, according to their rank and resources.[2]

HISTORY OF LATIN AMERICAN COUNTRIES

Even before Pizarro made his conquest of Peru, explorers had visited the east coast of South America and attempted settlement. Juan Diaz de Solis visited the estuary of the Platte in 1516 and Magellan later sailed up the river as one of the by-products of the journey of his vessels around the world. Pedro de Mendoza attempted to make settlement on the present site of Buenos Aires about 1535 but failed, largely on account of the hostility of the Indians. In 1580 the place was resettled by Juan de Garay. Meanwhile, Pizarro had begun his conquest of Peru in 1532, and Lima was founded in 1535.

The beginning of European life in Brazil was the result of discoveries of Vincent Pinzón, an associate of Columbus, and in 1500 of Pedro Alvares de Cabral, who is said to have taken possession in the name of the Portuguese monarch. This country followed a vacillating policy with reference to the new colony. At one time the King, João III, parceled out the land along the coast in captaincies, allotting large holdings to some fifteen grandees who had rendered service to the crown. Portugal did not enjoy an unruffled career in her new possession, for portions of the region were coveted by the French, Dutch, and Spanish. The first two countries took possession of portions of the north coast, while Spain laid claim to the land bordering on the Paraguay River. But eventually most of the huge empire was retained by Portugal.

The conquest of Chile was no easy matter, due to the mountainous character of the country. The first attempt, made in 1535, failed. A second attempt by Valdivia in 1549 was a little more successful, but the Indians continued to dispute the Spanish claims until 1640, when a treaty marked the river Biobío as the boundary between Spanish and natives. Portions of the north coast of South America were settled shortly after the Columbian discoveries. In Colombia, settlements were made as early as

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[2] C. R. Enock, *The Republics of Central and South America*, p. 349.

1502, but the Spanish did not succeed in overcoming the Indians until 1536.

The Spanish colonial system was applied rigidly to all American possessions. Import trade was carefully guarded in fleets sent out from Spanish ports, and the same vigilance was exercised over every commodity sent out of the colonies. Colonial production of goods which might have been supplied from the home country was prohibited, and trade from colony to colony was regulated so that such commerce should not interfere with that of Spain. The preëminent activity was the mining of precious metals, and such large quantities were sent home that business enterprise which might have been concerned with ordinary manufactures and trade was discouraged. However, the gold, which gradually filtered into the channels of trade, stimulated commerce elsewhere and inaugurated an era of commercial and subsequently of industrial development in the western nations of Europe.

The desire for independence in Latin America was inspired partly by the North American example, but the real opportunity came during the troublesome times brought about under the régime of Napoleon. There were loyalists in South America as well as in the Colonies in North America, who wished to retain the old allegiance. But the revolutionists gained the day. South America is a large continent and it took time to start revolutions on their way, and to bring them eventually to success. In a general way, it may be said that the revolutionary movement spread northward from Argentine. The patriots of the north gained not only inspiration but actual military help from such leaders as Simon Bolivar. The Argentinians gained a decisive victory in 1812; this paved the way for the Congress of Tucumán which declared the independence of the country. In time similar action followed in other countries. Our next-door neighbor, Mexico, began the struggle for independence about 1810, when Hidalgo, "humble priest of Dolores and called by the Mexicans father of his country, rang out the tocsin from his parish church, crying to his followers, 'Viva Mexico!' " But a long struggle was ahead, which was not settled until 1822 when Mexico disposed of Iturbide, one of its own countrymen, who aspired to be emperor. Then followed the usual run of dictators until about 1857 when Juárez inaugurated a new era of government, followed shortly by Porfirio Diaz who ruled with an iron hand for over thirty years, but who governed so well that he laid the foundation of such prosperity as the republic now enjoys. He encouraged railway building and the opening of the resources of the country, and he gave encouragement to foreigners to invest in such enterprises.

In all the mêlée of revolutions one country alone maintained its peace. This was Brazil. In 1807 the royal family of Portugal made peace with the English, as might have been done with Napoleon, by migrating to Brazil. The colonists were fairly well satisfied with the new government, and in 1821, when the royal family returned to Portugal, they were content to have the prince, Don Pedro I, as their ruler. His successor, Don Pedro II, ruled for fifty-eight years, and then November 15, 1889, by a peaceful revolution, the Republic of Brazil came into existence.

An interesting feature in the history of Latin American independence is that the various regions were not brought together, as with the United States, into a United States of South America. Instead, the larger divisions tended to split into small units. Bolivia, for example, was given the option of voting to remain with Argentine or to become independent. Bolivia chose the latter course. The regions of the north, Ecuador, Colombia, and Venezuela, started their career of independence as a united republic, but later parted company; and something of the same course marked the history of the Central American republics. The desire for closer union still lingers in the minds of many Latin Americans, but the time is far distant when this can be accomplished.

POPULATION OF LATIN AMERICA

The total area of the main divisions of Latin America is about 8,400,000 square miles; of this South America contains 7,383,000 square miles, Mexico 760,200 square miles, Central America about 215,000 square miles and Cuba 44,100 square miles. The population of these four divisions is about 95,000,000 of which 73,000,000 are in South America. As we have already seen in a former chapter, the economic capacity of the people of a nation is not only a matter of numbers but of industrial effectiveness, their attitude towards work, and the implements and tools with which they labor. In all these respects many millions of people in Latin America do not measure up to the capacity of the workers in the great industrial nations. For one thing, illiteracy is widespread. Conditions are probably best in Argentine. This country has provided not only a number of universities, as at Buenos Aires, La Plata, Santa Fé, and Córdoba—which is one of the oldest institutions of learning in the Americas—but for specialized schools of commerce, of viniculture, fine arts, mines, and music. Primary education is free, and it is also compulsory for children from 7 to 14. But notwithstanding the compulsory provision, only 42 per cent of the children attend primary schools, on account of the long distances they must travel. Most of the other countries have made ample provision for higher education, and in some cases, for specialized training in branches which are related to the peculiar industrial opportunities of the country. A number of countries have made education in the primary grades compulsory, but lack of appropriations and the great distances to school make full compliance with this provision impossible. In Colombia illiteracy is said to amount to 60 per cent; it is also 60 per cent in Paraguay, and from 60 to 70 per cent in Brazil.

The complex nature of the population imposes a serious problem upon the educators. Information on this question is very unreliable, but it is estimated that 40 per cent of the population of Brazil is white, 30 per cent mestizo, 20 per cent negro, and 10 per cent Indian. In the Andean countries the Indian element predominates, estimated at 60 per cent in Peru and Bolivia, while the white population amounts to 10 per cent. The same confusion prevails in Central America where the component parts are white, negro, and Indian, the proportions varying from country to country. The population of Mexico is said to be 15 per cent white, 50 per cent mestizo, and 35 per cent Indian. Argentine and Brazil contain the largest European elements—of recent immigration—with Italians making up the largest percentage.

IMMIGRATION

More than half the population of South America is in Brazil, estimated in 1927 at 36,000,000. These numbers are largely concentrated in the agricultural and industrial regions in the eastern and southern parts. Argentine contained over 10,000,000 people in 1927, largely concentrated in a radius of 300 miles about Buenos Aires. Colombia has a population of about 7,000,000, Chile about 4,000,000, and Peru about 5,000,000. These figures, of course, are estimates, because there are no means for making an actual enumeration in most of the regions.

In recent years Brazil, Argentine, and Chile have received large additions to their population through immigration. In fact, the movement into these countries has been rather large during the last twenty-five years—a condition which has been made possible by the expansion of farming and manufacturing industries which gave employment to foreigners. Lack of employment opportunities keeps immigrants away from the countries of the north and northwest. As a rule, the largest countries have held out various inducements to immigrants, such as temporary housing at low rates until the newcomers can be placed in some occupation, and either free transportation or carriage at low rates to ultimate destinations. At one time the Brazilian government subsidized certain Italian steamship lines which transported immigrants.

Since the beginning of immigration, some sixty years ago, from 3,000,000 to 4,000,000 foreigners have entered Argentine, and about an equal number have gone to Brazil. Uruguay and Chile have received a considerable number. The sources are rather widely distributed. An Argentinian estimate of about 1911 gave the following enumeration of immigration from 1857 to 1911: Italians, 2,052,000; Spaniards, 1,132,000; French, 201,700; Russians, 115,800; Austrians, 74,100; Syrians, 89,400 English, 48,500; Germans, 50,700; and in addition there were a small number of Portuguese, Swiss, and North Americans. These elements are also represented in the immigration into Brazil, although in somewhat different proportions. As a result of these migrations the populations of Argentine and Uruguay are more largely compounded with recent European stock than is the case with any of the other countries.

Immigrants have conferred an enormous benefit upon the countries to which they have gone. In fact, they are in a large measure responsible for the character and extent of the industrial development which has taken place in the four southern countries during the last twenty-five years. They have supplied the labor which has been absolutely necessary for the growth of trades and industries, and they have done much of the hard work in opening and mantaining plantations. But the immigrants have also brought in the newer ideas about industrial relations, shaded at times with socialistic tendencies, a condition which has sometimes been the cause of labor unrest.

FOREIGN INVESTMENTS

The economic development of Latin America has been dependent not only on immigration but upon the use of foreign business talent and upon foreign capital. The greater part of the technical work required in the building of railroads and in the opening of mines has been contributed by the English, Americans, and Germans. Mining engineers have been busy, particularly since 1905, in surveying and developing the copper, silver, tin, and to some extent, the gold resources of the Andean areas; and more recently similar work has been done in the development of petroleum resources along the north coast of South America and in Mexico. Shortly after 1870, English and German enterprise exploited the nitrate deposits of Chile, and English capital has been largely engaged in railroad building. A number of manufacturing industries, notably meat packing, owe their origin to foreign enterprise and investment; and, of course, most of the cargoes are carried to and from the Latin American coast in foreign vessels. The rise of modern industry in all this region has been coincident with the introduction of imported enterprise and capital.

Argentine and Mexico have probably received the greatest benefits, although the foreign business influence has been felt to some extent in all countries. In 1916 British capital in Argentine alone amounted to more than $1,800,000,000, chiefly in railways, but to some extent in land and investment companies, in commercial and manufacturing enterprises, and in loans to the government. French investors in 1916 claimed about $400,000,000, the Germans about $250,000,000, and investors of the United States in 1924 about $300,000,000. This same year British holdings in Uruguay amounted to about $230,000,000, mostly in railways and in national and municipal securities, but to some extent in public utilities. In Chile, the copper and nitrate resources have been the chief attractions, although certain amounts of foreign capital have been put in manufacturing and commercial undertakings. The mineral resources of Bolivia and Peru have also attracted foreign investment. Along the north coast of South America the newly revealed petroleum resources are now attracting British, American, and Dutch capital. In Cuba, tobacco and sugar have offered the chief opportunities, and in Mexico, petroleum, copper, silver, and to some extent, plantations, railways, and public utilities. In the two countries last named North American capital is the dominant factor, and investors of the United States are gaining the predominant position in the mining enterprises in the Andes. All in all, the total foreign capital involved in loans and investments in Latin America, is estimated at over $6,000,000,000.

There can be no doubt about the influence of this factor in opening resources and in the development of industries and commerce. The enormous investments in railways render many regions accessible which were closed to all kinds of enterprise some thirty years ago. Port improvements and warehouses facilitate the movement of commerce. The liquid capital supplied by foreign investments in banks contributes in the same way. Many loans to governments and to municipalities ultimately find their way into improvements of some description which are of assistance to commerce. The large sums loaned for the development of public utilities add most to the comforts and conveniences of the people. Foreign business and engineering talent not only contribute new ideas concerning industries, but supply the effective direction of enterprises.

Troublesome political questions are sometimes involved with the foreign investment of funds, and relations between borrowers and lenders are not always pleasant. There is a great deal of opposition in the United States to what has been called "dollar diplomacy," which probably means the using of the good offices of the State to protect foreign investments, including at times the collection of interest, particularly on government loans. It is not our purpose to prescribe rules for the guidance of creditor nations, but only to suggest that these discussions usually confuse political ideals with practical principles of social and economic welfare.

RESOURCES OF LATIN AMERICA

Because of the great variety of physical conditions, and on account of the enormous area, the Latin American lands have a vast potential capacity for production. Notwithstanding the great development of the past twenty-five years, the latent possibilities are as yet scarcely realized. The great mass of the South American continent lies in the tropics and its great forests yield useful products in great abundance. We have already learned something of the importance of these tropical timbers. The subtropical and temperate regions contain vast areas which may be used for grazing, and even for the production of cereals, when the demands for consumption make this use necessary. Thus, at some future time these regions may yield much larger supplies of wheat, wool, meat, and hides than they are producing at present.

Some mineral resources are already exploited on a large scale. One of the first of these to attract the attention of foreigners was the nitrate deposits of Chile. The earliest shipments were made in 1825, but the industry did not begin to reach large proportions until about 1870 when the export amounted to 150,000 tons; it became 1,400,000 tons in 1900, and 2,300,000 tons in 1910. The resource is easy to extract. The nitrate beds are found practically on the surface, and extensive mining operations are not necessary to bring the material to the surface. Chile is the only important source in the world of the natural nitrates. Whence came these deposits? "Various theories have been advanced as to their origin, but the one most widely accepted is that they were formed from deposits of seaweed on the bottom of an inland sea which was afterwards elevated by geologic forces."[3] Certain iodine salts are obtained as a by-product of the nitrates industry. Nearly 2,000,000 pounds of iodine were exported in 1925. The effect of the nitrate trade is felt in other economic activities. Not only does it attract foreign capital, but it requires the import of between four and five million dollars' worth a year of gunny sacks for nitrate shipment, and by providing a heavy return cargo it exerts a considerable influence on shipping to the west coast of South America.

Chile also produces iron ore, copper, calcium borate, coal, and it possesses potential resources of gold and silver. The mineral resources of Bolivia are no less varied. This country is one of the few regions in the world which produces tin. The ores and concentrates of this metal constitute more than 68 per cent of the value of the exports. But Bolivia also produces for export bismuth, antimony, copper, lead, zinc, and silver. Bolivia is the largest exporter of bismuth in the world. Much of the country is as yet inaccessible, and it has a capacity for mineral production much greater than at present. Since the opening of the country by the Spaniards it has been estimated that Bolivian mines have yielded over two billion dollars' worth of materials.

Peru also contains a great variety of minerals, including quicksilver, vanadium, tungsten, nickel, antimony, zinc, borax, cobalt, asbestos, manganese, magnesium, and mica. But at present the chief mining interest is concerned with copper and vanadium. Capital and enterprise are supplied mostly from the United States. Peru also has resources of gold, silver, petroleum, peat, lignite, and coal. As with other Andean countries, the rugged mountainous conditions impose great difficulties in constructing railroads, and in a similar way discourage the exploitation of the varied resources. Only the most accessible are developed. But the rich deposits indicate what the country may produce at some future time when better means of carriage have been provided.

The most notable mineral products of Colombia are platinum and emeralds, although the country is known to possess gold, silver, lead, and iron. Colombia is one of the principal producers of emeralds, and ranks second to Russia in the production of platinum. At one time production of gold was an important enterprise. In fact, since the beginning of mining, the country is said to have yielded more than $700,000,000 worth of the yellow metal. On the whole, the mineral resources of the Andes have been only imperfectly explored; at present it would be hardly worth the effort to make the surveys because, in many cases, it would be impossible to transport mining machinery, and almost as difficult to maintain a working organization at places distant from civilization.

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[3] Special Agent Series. No. 81, p. 105.

The principal mineral resources in the eastern sections of South America are in South Brazil. Diamonds were discovered in 1721. At one time the country was one of the greatest sources of supply. At present, the enterprise is conducted only in a desultory manner. "The work is not organized, but is carried on largely by individuals, who use little but a large wooden bowl for washing the gravel, a hammer, a crowbar and a scoop. Some diving is done in the rivers, and dredging has been tried, but with doubtful success because of the great expense."[4] Brazil, however, produces considerable quantities of black diamonds, or carbonados, which are sent abroad and used for drill points. Of much more importance are the deposits of manganese and iron. These deposits are partly controlled by English and American capitalists. The export of manganese ranges from about 150,000 to 300,000 tons, and many million tons are as yet untouched. With respect to development of iron resources, Brazil labors under the handicap of lack of coal, and high cost of transporting ore to the seaports. Monazite sand is one of the peculiar resources of the country; in fact, the known resources are greater than those of all the rest of the world.

Petroleum occurs in a number of places in South America, but at present development is being carried on mainly in Argentine, Peru, and Venezuela. The resources of the last-named country are now undergoing vigorous development.

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[4] *Ibid.*, p. 80.

FOREIGN TRADE OF LATIN AMERICA

The export trade serves the purpose of paying for imports and discharging debts to foreigners for various kinds of services, such as payment for carrying freight, insuring ocean cargoes, payment of interest on borrowed funds, partial repayment of the principal, to name only a few of the invisible items of trade.

Publishers Photo Service

Grain elevators in the harbor of Buenos Aires

All the Latin American countries are not only debtors, but they carry and insure very little of their ocean freight, and consequently freight and insurance bills are added to their international debts. Their exports, therefore, must exceed their imports in order that these debts may be discharged. This is the case, although in certain countries, borrowing may for a time postpone the inevitable excess of exports. In 1926 the excess of Latin American exports over imports amounted to about $320,000,000.

To a large extent, the annual discharge of these debts rests on a rather uncertain basis, because, in the case of most of the countries, the prosperity of the export trade depends on one or two commodities, or classes of commodities. In the case of Chile, for example, in 1926, about 73 per cent of the exports were made up of shipments of copper and the nitrates; with Bolivia, tin amounted to 68 per cent of the exports; with Ecuador, cacao amounted to 42 per cent; with Cuba, sugar amounted to 72 per cent of the export trade; with Brazil, the coffee trade amounted to 73 per cent of the total; and in the case of Colombia, coffee is about 60 per cent of the total. It might be observed in passing that Colombia seems to be getting the benefit of Brazilian valorization, which tends to maintain the price of coffee above the competitive level. The export of coffee has been growing rapidly in Colombia, expanding from about $13,000,000 in 1915 to $68,000,000 in 1924.

Apparently, the export trade of Argentine rests upon a more certain basis since this trade includes a number of large items, but, in fact, about 74 per cent of the trade is based on cereal and animal products, although the items appear to be different—such as frozen and chilled beef, mutton, tallow, butter, wool, hides, sheep skins. The exports of Mexico are much more diversified, including not only crude petroleum and its refined products, but henequen, copper, lead, gold and silver bullion, chicle, coffee, and a number of commodities of smaller importance. In 1926 the total export trade of South and Central America, Mexico, and Cuba was over $2,500,000,000. The leading exporters in South America are Argentine, Brazil, Chile, and Colombia, in the order named. Both the export and import trade are distributed among a number of countries; but the United States obtains a generous share of Latin American commerce; the United Kingdom and France are also large participants, and before the War Germany enjoyed a high trade rank in most of the countries. There is a considerable amount of trade among the Latin American countries themselves.

MANUFACTURES

Except in the three large countries in the south, manufactures are of little importance; production is either in small shops or by domestic industry. The import trade supplies a great number of commodities which cannot be produced locally. The manufactures of Argentine are of considerable importance. The meat-packing industries are the most highly organized manufacturing enterprises in Latin America. In addition Argentine produces sugar, wine, quebracho extract, flour, furniture, some textiles and boots and shoes. The manufactures of Brazil include cotton, woolen, and jute piece goods, paper, flour, leather, boots and shoes, carts and wagons, among others. The larger countries are endeavoring to encourage the development of manufactures, and employ the protective tariff for this purpose. But the large import trade indicates that these countries must depend on the outside world for many commodities. There are no considerable manufactures of iron and steel, nor of machinery, nor even of textile fabrics. Thus, all Latin America is an importer of the textiles; of iron and steel; of many kinds of machinery, including electrical wares, automobiles, trucks, railway cars and locomotives; railway steel, chemicals, and cement. Some countries import lumber, kerosene, gasoline, pork products, wheat flour, and coal. Patent medicines, agricultural machinery, phonographs, radio sets, and many other commodities are among the imports.

TRANSPORTATION

One of the greatest handicaps with which Latin America has had to contend is lack of means of transportation. In some respects the rivers afford an adequate means of carriage. The Amazon extends almost across the continent, and the construction of a railroad around the falls of the Madeira has extended the limit of navigation into Bolivia. In the south, the La Plata system affords another rather extensive entrance into the southeastern portion of the continent, and the Orinoco performs a similar service in the north. Colombia has some advantage in transportation over the Magdalena, and Brazil has a number

Ewing Galloway

Meeting place of the railroad and llama caravans in the Andes of Peru

of navigable rivers. But the west coast is poorly served by water communication; the rivers are short and swift and are unfit for navigation. This section is richly endowed with mineral, forest, and agricultural resources, but many thousand square miles of this territory are inaccessible. Moreover, railroad building in the mountain areas is difficult and expensive. As a rule, the roads are short lines connecting some interior point with a seaport, or joining other short lines. In many instances, the gauges are different. Because of the difficulties of construction the proposed Pan-American railroad is still many years in the future, although there now exist numerous short roads which may in time become links in the great system.

The level country of Argentine has been a great boon to the railroad builder and this section is now fairly well provided with rail transportation. Argentine contains 23,700 miles of railway, and Brazil 19,000 miles. There are 5,300 miles in Chile, 2,000 miles in Peru, a little more than 1,000 in Colombia, and 1,800 miles in Uruguay. The other countries contain a very small mileage. South America has only one transcontinental railroad, across the narrowest portion of the continent from Buenos Aires to Valparaiso, and others are in prospect, stretching westward toward some of the ports of northern Chile and Peru. On the whole, the railway mileage is highly localized in a relatively small area tributary to Buenos Aires, Santos, and Rio de Janeiro.

QUESTIONS

1. How do you account for the tardy development of the Latin American countries?

2. Does the different scale of social values in Latin America largely account for differences in economic development in South and North America?

3. In what respect has the mental attitude toward work in Latin America been a retarding influence?

4. Discuss briefly the immigration policy of the South American countries.

5. Did the Spanish colonial system offer serious obstacles to industrial progress in Latin America? Would progress have been much greater if Spain had given the colonists a free hand?

6. Contrast the history of Brazil with that of other Latin American countries.

7. Why did not Latin America come together in a United States of South and Central America, on the North American model?

8. Discuss the social conditions in Latin America which have affected industrial progress.

9. Explain how foreign investments have aided in the recent development of Latin America.

10. What are the leading resources of Latin America? To what extent are these now under development?

11. Why do Latin American exports usually exceed the imports?

12. In many cases the export trade of a number of Latin American countries is made up of two or three large items and a considerable number of smaller ones. Account for this condition.

13. Is it to the disadvantage of a country to rely chiefly on two or three articles as principal exports?

14. Discuss manufacturing and transportation conditions in Latin America.

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CHAPTER XXVI

RESOURCES AND DEVELOPMENT OF THE UNITED KINGDOM

Britain was a pioneer in most of the fields of modern development and many of her present advantages are due to the accumulated results of an early start. In the development of commercial banking as applied to domestic uses and to foreign trade, in the accumulation of surpluses of capital for investment at home and abroad, in the development of colonial empire designed, for one thing, to round out the markets of the home country and to supply needed raw materials, and in the early development of the factory system, Britain was many years in advance of the other present industrial nations.

ADVANTAGES FOR INDUSTRIAL DEVELOPMENT

Britain's advantages lie partly in features which are visible to the eye, such as certain obvious physical conditions, but perhaps more largely in the things which are not seen and certainly not understood, except by those who are accustomed to make analyses of economic conditions.

The cumulative effect of early advantages now stands the country in good stead when a number of nations have risen to commercial and industrial importance and are contenders for a share of the international trade, particularly when these nations by the use of tariffs try to build up domestic industries and trade by excluding from their borders as much of imported commodities as threaten the welfare of home industries. In many cases, until 1800, and possibly later, domestic resources more than sufficed for the needs of English manufactures. In fact, there was a greater need for markets for finished products than for raw materials. With respect to resources, the country was more nearly self-sufficing than today when the need is as urgent for essential raw stuffs as for markets in which to sell finished goods. As with other countries today, the great diversification of industries, and the exacting requirements of manufacturers, have made necessary a quest of all corners of the globe for appropriate materials. Britain shares this handicap along with Germany and France, but it is a condition from which the United States is largely spared, due to the great abundance and variety of materials found within the borders of this country. But Britain enjoyed advantages which the other nations did not possess, at least in the earlier stages of growth.

Not the least of these was her isolated position. Britain participated enough in Continental wars, but the narrow channel which separates the islands from the main body of the Continent saved the country the devastating effects of invasions—a condition with which most of the continental countries were afflicted. It meant much to the rising industrial nation to be permitted to develop its farms and manufactures without interference. Although for centuries the policy had been to maintain a large fleet, it was not necessary to keep the standing army on the same footing with some of the Continental countries. Funds which these other nations wasted in military preparation and defense were saved, in the case of England, for investment in commerce and industry.

At least in the earlier stages of the Industrial Revolution, Britain was well supplied with the industrial minerals. Coal and iron were abundant, as they are today; the home resources supplied copper, lead, and tin; the need for the minor industrial metals, which Britain does not produce, had not yet emerged. Iron was imported from Sweden, particularly for use in the cutlery industry; the policy of conserving the forests for shipbuilding brought some ironmasters to ruin by denying them sources of charcoal. In fact, throughout most of the eighteenth century considerable quantities of iron were imported from Sweden, Russia, and the American colonies, but this was due not to a shortage of ore but of charcoal; and the colonies were encouraged to export raw iron not because England could not produce it herself, but because she considered the conservation of the forests of paramount necessity. Discoveries of methods of using coal in smelting, for which Abraham Darby was partly responsible, relieved England of the need of drawing upon her forests, and in the course of time the iron industry was independent of outside sources, except for ores, or raw iron, used for specialized purposes. At times, England was an exporter of lead, copper, and tin. The country was also largely self-sustaining with respect to the ordinary raw materials supplied by agriculture. Wool was then the most important textile fiber, and for centuries England produced more than enough for home consumption. Heavy, coarse, cotton fabric was produced early in the sixteenth century, using imported cotton, and shortly after 1700 the manufacture of calico was stimulated by prohibiting the import of this product, but the demand for raw cotton was small. The great expansion of cotton manufactures had to await the introduction of the new textile machinery, shortly after 1750.

The most notable shortage of raw material was timber, and the lack of this material was a handicap to a number of industries including the production of iron. Lumber was one of the principal articles which the colonies were expected to supply. Conditions with respect to raw materials changed with the coming of the industrial era, and the country became more and more dependent on the outside world.

One great advantage which Britain long possessed was the skill of her artisans. This was true of various kinds of metal work, textiles, and pottery. The country was fortunate in adopting a liberal immigration policy, with the result that many new crafts were introduced.

> Much of the advance in industry was due to the skilled refugees who, for two hundred years, poured in a steady stream from the continent to our hospitable shores. . . . Very many industries rose to importance as a result of their teaching. All the finer kinds of work in cloth, silk, damask, velvet, cambric, and tapestry were in their hands; paper-making, glass-working, the manufacture of clocks and watches, and of pottery, owe their introduction into England to refugee enterprise. . . . Care was taken that they should have English apprentices to learn the trades from them.[1]

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[1] F. W. Tickner, *Social and Industrial History of England,* p. 348.

The Huguenot immigration was said to have numbered 50,000 and to have represented a capital of £3,000,000. This new labor not only provided a more ample supply of goods for domestic consumption, but by diversifying English manufactures it enhanced her opportunities in foreign markets. In the course of time the country developed a reputation for quality, and for trade names associated with goods, which were difficult to displace even when other nations had grown to power as exporters.

Various physical factors have contributed to the expansion of industries. For one thing, climatic conditions are favorable for human exertion throughout the year. There is little or no interruption of work on account of inclement weather. It is even said that persons who are born and bred under the climatic conditions of the British Isles find weather conditions stimulating. Be this as it may, there is nothing in the situation to impede work. Both soil and climate favor the production of staple crops; the only handicap in this respect is the limited area for cultivation. With the increase of numbers, due to the growth of industrialism, the country has been forced to rely on foreign sources for a large portion of food supply, to say nothing of agricultural raw materials. It would be possible to grow more wheat on British farms, but for many years foreign competition has discouraged much of this enterprise. The rise of prices subsequent to the late War seemed to have revived some of the interest in the production of cereals.

In the days of canal building the numerous streams facilitated transportation improvements. In later days, the railway builders found no serious handicaps to the spread of their work. Upon occasions, the broad estuaries of certain rivers, such as the Thames, Severn, and Mersey, created troublesome problems, but these were only local difficulties. Britain possesses an unusual number of good seaports—a condition which helped to diffuse industrial activity over the country and to promote the development of a number of trade and industrial centers; the existence of important deposits of coal in a number of parts of the island works to the same end.

Possibly, proximity to the continent, and a location which might be regarded as a western terminus of the Continental trade lines, might be considered as an advantage. But commercial position is probably a result and not a cause. It is the result of numerous factors which have built up a powerful foreign trade organization.

COMMERCIAL ORGANIZATION

One great advantage which the country enjoys is a great commercial organization built up through several centuries of trading. Financial power is one of the greatest elements in this system, and this includes not only the gradual accumulation of surplus funds for investment abroad and at home, but adequate commercial banking arrangements which have made possible the handling of trade in many parts of the world. Only those who have contact with this system can thoroughly appreciate its significance. With the development of banking institutions, money came out of the hoards and was deposited where it could be used for trade purposes. In this connection, the founding of the Bank of England in 1694 marked an era not only in the development of industrial finance, but in the expansion of trade. Funds were gradually accumulated and put into home industries and invested overseas; this process was of course cumulative, so that in time the country came into possession of huge amounts of commercial and investment capital.

Foreign trade was one great source of profit. One of the early connections with the outside world was through the trading-company organization; but interlopers also shared in the foreign trade, and in the profits, and they also established trade connections. Trading factories were founded wherever merchants could make profitable contacts. As a rule, these were managed by experienced men from the home country, and they left no stone unturned to spread the influence of their establishment, which meant the sale of goods, and the harvesting of profits. With the expansion of British commerce this trading organization spread throughout the world. Britishers were concerned primarily in handling home products and in spreading the goodwill of the home country. Through these factories, agencies, controlled merchants—whatever one wants to call them—the lines of commercial connections radiated from the trade centers of Britain to many parts of the world. In time, banking connections were established in these outposts, and merchants gained another advantage of having their own home institutions transmit funds, or buy and sell, exchange, or discount notes. Thus bankers and merchants campaigned together for the promotion of commerce.

The development of shipping was another important element in this organization. Several hundred years ago there was much more truth in the statement that "commerce follows the flag" than today, because trade was in the hands of merchant shippers. These agencies were commercial pathfinders which gradually built up profitable sources of trade; in later years this was of great advantage to the specialized shipping companies. Today, the merchant marine, like the railroad in domestic commerce, is a great source of income, which is paid in one way or another to the owners in the home country. In 1926, British owners probably claimed about 30 per cent of the returns for carrying ocean freight—at any rate, Britain controlled this per-

Aerofilms, Ltd.

Docks in the port of Liverpool

centage of world tonnage. Whether profits were realized is another question, because of the competition due to the ten million or more surplus ocean shippings.

In the course of time British commerce was supplied with another important element in the international commercial organization, namely, facilities for the insurance of ocean cargoes; it was no longer necessary, as was the case with the Merchant of Venice for shippers to carry their own risks. Brokers who gathered at Lloyd's coffeehouse, in addition to other business, were not averse to assuming some of the risks of loss on ocean vessels and cargoes.

It might be observed in passing that these various commercial services not only promoted the export trade of Britain, but were powerful agencies in building up import commerce. The profits on foreign banking were either retained for the further development of the foreign business or remitted to the home country. Profits on trade, likewise, returned to England. The charges for carrying the freight of foreigners, and insuring their cargoes, were credits which owners at home were entitled to receive. In this way the national commercial organization gradually built up foreign credits, which increased annually, and that part which was not left abroad as a permanent credit, or investment, was returned in the form of shipments of goods. In these various ways, the growing commercial organization developed not only export, but import trade.

EFFECT OF COLONIAL EMPIRE

There may be some ground for debate of the issue whether colonial possessions are merely a matter of political prestige, or more largely a question of commercial gain. At least in the earlier stages of development, colonies are expensive to maintain, and at all times they require expenditures for military and naval defense. Under the mercantile system, colonies were regarded as possible markets for home manufactures and sources of raw materials. In the days when all nations were restricting markets, which they controlled by navigation acts and by prohibitive tariffs, about the only way a country could expand its overseas trade with certainty was to develop colonial markets. In modern days there is commercial advantage in the fact that the home government can secure stability in the political institutions of its dependencies and thereby gain favorable conditions for the spread of industries and commerce. This condition, also, encourages the investment for the development of resources. Sometimes, preferred treatment of the commerce of the home country adds to the advantage of trade.

RESOURCES OF THE UNITED KINGDOM

We have already referred to the resources which were available during the early development of the country. One significant feature in the economic development of Britain is that along with her industrial expansion she has become more dependent on the outside world for raw materials and for markets. This has been notably the case with the textiles, the greatest single branch of enterprise in the country. Wool is the only textile fiber of which the country produces any considerable quantity, and at that, the domestic supply is below the requirements of her industries. Thus textile manufactures are based largely on foreign raw materials.

Today, coal and iron are the greatest resources. The coal supply can satisfy the needs of industry for many years even at an increasing rate of consumption, although the cost of production will show a marked increase. Deposits existing in six or eight important fields are well distributed. From the point of view of present production the most important are the Yorkshire coal field between Leeds and Derby, the South Wales field, the Northumberland and Durham field, between Warkworth and Darlington, the Scottish coal fields, mainly in Lanark, Fife, Ayr, and Edinburgh, the Lancashire field, and the Staffordshire coal fields.

Coal has been consumed to a limited extent in England for centuries, but coal mining, in the modern sense did not come into existence until shortly after 1750. In fact, this industry had to await the invention of devices which made extensive development possible. The most important was Watt's steam engine used for pumping of water from mines and hoisting of coal. Since this fuel is the main source of mechanical power it has been justly regarded one of the chief bases of industrial strength. In 1913 the United Kingdom produced 287 million tons of coal, and in 1925 about 248 million tons.

Periodically, during the last ten or fifteen years, the coal industry has encountered serious interruptions due to labor disputes. In 1926, the government paid a bounty on production virtually to maintain peace in the industry, and in the hope that in the meantime a satisfactory solution to the coal problem could be found. In some respects the British difficulties are like our own, namely, too many miners, and in many cases, inefficient operation. Within the last two or three years there has been a tendency towards voluntary consolidation within the industry as one solution to the coal problem. The purpose of combination is to centralize sales and purchase, to obtain more effective direction, and to improve mechanical methods. Until the industry was beset by recent troubles, Britain was a large exporter of coal; in many instances, the coal was carried as ballast, thereby giving outgoing vessels a valuable cargo, and at the same time serving to promote the export trade in coal.

Iron is the second most important resource. The supply is not as abundant as coal, and it has become necessary in recent years to supplement domestic productions with imported ore. Production in 1913 was nearly 16 million tons, and imports of ore the same years were over 7 millions tons; production in 1925 was about 10 million tons and imports about 2 million. The principal fields are the Cleveland district of Yorkshire, the Furness district of Lancashire, South Wales, Sheffield, Staffordshire, Northampton, and the Forest of Dean. The country is not as fortunate in possession of other metals. Britain produces some tin and lead, but not enough for domestic needs. The country is a large importer of these two metals and of copper, to say nothing of various supplies of the minor industrial minerals. Other products of mines and quarries are china clay, marble, sandstone and building stones, and zinc.

We have already referred to the shortage of lumber and timber products. This is a matter that has troubled the country for many years, but there is no solution to this problem, except by recourse to foreign supplies. The timber resources of north Europe are not far distant and Britain draws heavily on this source. In 1925 only 1,100,000 hectares were under timber in Great Britain, or about 5 per cent of the total area, which was the smallest amount in any European country. In 1926 the United Kingdom imported about 538 million board feet of hard and soft wood, and more than 1,300,000 tons of wood pulp.

As a rule, farmers find it difficult to compete with imported cereals, and crops are relatively small—in 1926, 51 million bushels of wheat, 48 million bushels of barley, and 177 million bushels of oats. The potato crop more nearly approached domestic needs, with an output of 176 million bushels. Although the wheat crop is relatively small, the yield per acre is about 31 bushels (1926), which is about twice that of the United States. The same statement with reference to the insufficiency of the supply applies to products of the livestock industry. In 1925 there were 8 million cattle, 3 million swine, and 24 million sheep on the farms of the United Kingdom. Britain is therefore a large importer of beef, mutton, bacon, lard, butter, hides, leather, and wool.

The fisheries are a more prolific resource. The waters around Great Britain contain many kinds of fish and "the industry is pursued with great success by a vast army of fishermen, certainly not less than 40,000. There are many well-known fishing ports in various parts of the United Kingdom, particularly Hull, Grimsby, Yarmouth, Harwich, Lowestoft, Ramsgate, Penzance, Plymouth, and St. Ives; but the greatest center is Billingsgate Market in London, the largest fish market in the world."[2]

THE INDUSTRIAL REVOLUTION

The change from the old to the new industrial order began to take place in England shortly after 1750. The spirit of invention was in the air at this time, although it did not begin to produce material results until 1764 when the Blackburn carpenter, James Hargreaves, developed the idea of spindles attached to a frame and operated from a common source of power. Apparently, Hargreaves did not conceive the full possibilities of his device because he attached to the frame only a small number of spindles, but his competitors soon began to add to the number. In 1769, Richard Arkwright devised a somewhat more successful machine based upon a principle which had been conceived some twenty years before by Lewis Paul and John Wyatt. This new invention combined the processes of drawing and spinning, and produced a stronger yarn, with the result that the manufacture of goods entirely from cotton now became a commercial possibility. The drawing was performed by several pairs of rollers, each forward pair revolving at a greater velocity than the set preceding. The cotton was then passed on for twisting into yarn. In 1779, Samuel Crompton combined the water frame of Arkwright with the spinning jenny, with the result that the new device produced a much finer yarn. Then, in 1785, Edmund Cartwright paved the way for the invention of a power loom. His own invention was hardly practicable, but subsequent workers improved upon the idea, and the power loom came into general use after 1813.

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[2] Pitman's *Commercial Atlas*, p. 8.

One of the most interesting features of this era of invention, and one, by the way, which shatters some of our theories was that only one of these epoch-making improvements came from the brain of a man who was a spinner by occupation, namely, Crompton. Arkwright seemed to have been a rolling stone, but at one time he was a barber and a peddler of wigs; Cartwright was a clergyman, and Hargreaves a carpenter. Another interesting feature was that the inventions applied to cotton, which at that time was a minor textile fiber. But the effect was to bring this material forward as the most important material. The cotton gin invented by Eli Whitney was an important step in this sequence of improvements. While the inventors are entitled to full credit for their performances, the total outcome was the result of an association of ideas by means of which one worker obtained suggestions from what had been done by the others. In other words, invention is both cause and effect, and this is true of the many minor improvements.

From the point of view of industrial progress the most significant feature of these discoveries is that they were output-multiplying devices. The weaving improvement of John Kay, invented in 1733, doubled the pace at which weaving could be done. The devices of Arkwright, Crompton, and Whitney manifolded the output many times, and, of course, subsequent improvements multiplied many more times the work which a man could do.

This was also the significant feature of the steam engine which was improved by James Watt to such an extent that it was really entitled to the name, because it utilized the expansive power of steam in driving the piston in both directions. No one can question the fact that the traction engine devised by George Stephenson manifolded working power in enormous proportions. The opening of the Stockton and Darlington Railway in 1825 marked the beginning of the railroad era in England. With the inventions applying to the textile trades, to transportation, and to the use of steam power for general industrial work, the business world was equipped for real progress.

England gained a marked advantage over its competitors because these inventions were first developed in this country. In a brief period the economic organization adjusted itself to the changes and picked up both industrial and commercial momentum. It was necessary to develop foreign markets more vigorously to dispose of the output of the new manufactures, and in this work the reduced cost of production by mechanical means gave England new opportunities which its competitors did not possess.

Today, industrial nations export machinery even to their competitors, but in the early years of the Industrial Revolution, England sought to retain a monopoly of inventions by prohibiting their export. This was a futile policy for two reasons: Actual knowledge of these mechanisms was smuggled into other countries in one way or another. Samuel Slater, for example, called the "father of American manufactures," upon his arrival in the United States, was able to reconstruct the Arkwright machines. In the second place, the mere knowledge that English inventors were working on certain ideas stimulated inventors elsewhere to similar endeavors. Even the spirit of invention in one country led to emulation in others. A number of Americans were trying to perfect steam engines at the time Watt was laboring with his invention, and subsequently, the tubular boiler was invented almost simultaneously in several countries.

GROWTH OF POPULATION

The mercantilists assigned as one of their reasons for interest in colonies that the dominions would afford a new home for the surplus population of the British Islands. They could not foresee the changes in industry which made possible the maintenance of a large population. No one knows the population of England in 1760, for the government had not yet adopted the policy of census taking, but the numbers have been estimated at 7,000,000. By 1821 the population had become 12,000,000. One effect of the development of manufactures was to draw people away from the country areas into the manufacturing towns and cities. In 1811 the rural population of England amounted to 35 per cent of the total, and in 1831 to only 28 per cent. The growth of such cities as London, Liverpool, and Glasgow was notable. This concentration of people in the cities has continued to the present day. In 1921 the population of England and Wales, which was classed as urban amounted to 79.3 per cent of the total. While a similar movement has taken place in the United States, our urban population in 1920 was only 51.3 per cent of the total. In fact, one of the great features of countries where industrialization has taken place, perhaps one of the most distressing characteristics, is the concentration of people in urban communities. Many of the most serious problems of today grow out of this situation. The population of the British Islands today is about 45,000,000.

GROWTH OF MANUFACTURES

The shift from the old domestic system to factory production brought great hardships to many classes of workers. But there were some who benefited immediately. This was the case of workers in the building trades, for the demand for construction in the growing cities was more rapid than the rate at which trained workers could be supplied by the trades. The skilled workers in the machine crafts enjoyed a similar advantage. Progress continually destroys old balances; it takes advantages away from one group and shifts them to another. A balanced state of industry is the one thing which does not characterize a progressive society.

But temporarily, at least, some changes brought great hardships.

Shipbuilding works at Glasgow

The mass of the industrial population became wage-earners only, without that interest in their work which the old gild workers, who owned the product of their labor had. They suffered also in many ways, especially in the earlier days of the change, for, although the new methods led to greatly increased wealth, they did not always lead to greater comfort and happiness. The old personal relations of employer and employed, which in earlier days had kept master and worker on fairly friendly terms, now disappeared in many cases. Production of a large scale for distant markets led to periods of unemployment, and at times to lessened wages. The people were clustered together in smoky towns where they could not add anything to their income by work in agriculture, while the lack of sanitation resulted in much disease.[3]

Moreover, the growth of industries, and the further expansion of the foreign trade, made the country less self-sustaining. It became necessary to look beyond national borders for foodstuffs, for increasing supplies of a number of the metals, for large amounts of timber products, and for textile fibers. To an ever-increasing extent Britain became a workshop where foreign materials were manufactured into finished form for local consumption and for sale in a wide foreign market.

The textile industries are the most important manufacturing enterprises, and of these the cotton textiles occupy the front rank. In 1924, nearly 1,400,000 wage-earners were employed, and the output was valued at $1,600,000,000. The iron and steel industry gave employment to 396,000 workers, and the value of the product was $1,100,000,000. The engineering trades, including the production of electrical, marine, and textile machinery, was an important branch, employing nearly 500,000 workers, with a total manufactured product valued at $988,000,000. In 1924, there were about 1,100,000 persons engaged in production from mines and quarries, mainly coal; the value of the product was $1,105,000,000. Among other important industries were shipbuilding; the manufacture of foods, tobacco, and liquors; railway construction and repairs; and the manufacture of chemicals and paper. The manufacture of motors and motorcycles produced commodities valued at $414,000,000.

FOREIGN COMMERCE

Many persons in Britain today would contend that the progress of the nation in industries and commerce was due mainly to the policy of free trade. But, as a matter of fact, this growth was the result of many variables, and it is difficult to decide which were the most important. The Navigation Acts passed out of existence in 1849, and legislation in 1853 and in 1860 fostered by Gladstone removed the protective duties. Not that imports were entirely free from tax, because the country still imposed a considerable number of duties for revenue purposes. No doubt, the statesmen of the time thought that England was blazing a new trail in foreign-trade policy which other European nations would follow. Cobden expounded the free-trade doctrine to the people of the continent, and for a time there seemed to have been considerable interest in freer commerce. But this sentiment disappeared on the continent after the Franco-German war. The growth of a strong sentiment of nationality, the industrial ambitions of a number of the nations which were likewise beginning to expand, and the growing competition of the foreign trade led to a strong revival of interest in protection. Britain, however, continued with the free-trade policy. Whether she will be able to maintain this course is a question. The growth of protectionist sentiment is a part of the aftermath of the late War. Many British industries have been depressed, and the competition of foreign goods in the home markets is at times a source of distress. But, on the other hand, free trade still has many staunch advocates.

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[3] Tickner, *op. cit.*, p. 540.

In Europe, the textile industries, and iron and steel, have suffered particularly since the War. The status of iron and steel is shown in the following statement:

> The aggregate consumption of iron and steel in the United States in the year 1925 was nearly half as big again as before the war, while the aggregate consumption in the leading European iron and steel countries dropped by about 5 per cent. These countries have not been able to find compensation for the decline in their home consumption by increasing their exports to the other European countries, and have been faced in their overseas markets by the competition of growing indigenous industries so that their net exports in 1925 were even less than in 1913. Their total production of finished iron and steel therefore remained below that of the last prewar year.[4]

The continental steel producers sought relief from their troubles in the iron and steel agreement of September 30, 1926.[5]

Exports of domestic raw materials from the United Kingdom are remarkably small, as might be inferred from our former discussion. In fact, this class of goods in 1926 was less than 10 per cent of the total. But the export of partly or wholly manufactured commodities was 78 per cent of the total. Britain now relies largely on the outside world for raw materials and pays for these by shipment of manufactures and by rendering certain kinds of services, such as transporting freight, insuring cargoes, and lending funds for investment. For these reasons, imports usually exceed exports, sometimes by sizable figures. Another important feature of British foreign trade is the large amount of reëxport business which was $342,000,000, as an annual average in the five-year period ending with 1905, and $610,000,000 in 1926. The foreign trade by periods since 1901 is shown in the appended table.

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[4] *Europa,* 1928, p. 68.

[5] *Cf.* Chapter XXVIII.

FOREIGN TRADE OF THE UNITED KINGDOM BY PERIODS

(000,000 omitted)

Year	General Imports	General Exports	Reëxports	Net Imports	Domestic Exports
1901–5	$2,637	$1,787	$342	$2,295	$1,445
1906–10	3,066	2,374	440	2,626	1,934
1911–15	3,628	2,719	503	3,125	2,216
1916–20	6,022	3,642	498	5,524	3,145
1921–25	5,131	3,890	555	4,576	3,335
1926	6,038	3,777	610	5,428	3,167

The distribution of the export and import trade among the various classes of goods is shown in the following table:

IMPORT AND EXPORT OF COMMODITIES BY CLASSES, UNITED KINGDOM, 1926

Class	Per Cent of Total	
	General Imports	Domestic Exports
Food, drink, and tobacco	41.0	7.3
Raw materials and mainly unmanufactured	30.4	6.8
Wholly or mainly manufactured	24.4	78.0
Bullion and coin	3.8	5.5
Minor classes	0.4	2.4
TOTAL	100.0	100.0

The United States is by far the largest source of the imports brought into the United Kingdom. In 1927 this country supplied 16.4 per cent of such imports; Argentine ranked second, supplying 6.3 per cent of the total, and British India was third, with 5.4 per cent. The most important consumers of British goods are India (12.0 per cent in 1927, Australia (8.6 per cent), the United States (6.4 per cent), Germany (5.9 per cent), the Irish Free State (5.1 per cent), the Union of South Africa (4.3 per cent), and Canada (4.1 per cent).

No doubt, Britain is the natural market for much of colonial commerce, partly because British capitalists have invested huge sums in colonial development, and partly because the trade organization is largely dominated by British influence. Old established relations tend to keep trade flowing in the former channels, an occasionally colonial, or imperial, preference with respect to empire commerce is of advantage to the home country. In 1919, the possessions supplied the United Kingdom with a little less than one-third of the imported foodstuffs and tobacco, and with about half the other industrial materials, such as wood, timber, cotton, wool, oilseeds, nuts, fats, hides, and skins. In 1919 about 35 per cent of Britain's import trade came from the possessions. It is by no means certain that the Dominions will continue to be as good customers in the future as in the past. Many aspire to become manufacturers of their own materials and for this purpose impose protective tariffs to encourage home production. There is competition within the Empire as well as with the outside world, but this is inevitable in view of the ambitions of some of the units to round out their economic systems.

QUESTIONS

1. In what fields was Great Britain a pioneer in modern industrial development? In what respects did this early momentum give her an advantage over other countries?

2. Britain's advantage lies "more largely in the things which are not seen and not often understood." In what unseen things, for example?

3. To what extent is Britain now dependent on foreign markets for (*a*) raw materials; (*b*) consumption of her surplus manufactures?

4. What are the leading industrial resources of the United Kingdom today? What great raw materials does not Britain possess?

5. Explain how a country which is notably deficient in many leading raw materials can maintain a high rank as a manufacturing nation?

6. Does the location of Britain just to the west of the Continent cause her to be the center of the trade lines focusing on Europe, or have some other factors caused trade lines to center in this way?

7. Explain how and why the commercial organization of Britain has been a great factor in her economic development.

8. How much influence is to be attributed to her financial power in her economic development?

9. How much has control of shipping contributed? Is it true today that "commerce follows the flag"? Why?

10. What are the national advantages of control over a large merchant marine?

11. To what extent have colonial possessions contributed to the industrial upbuilding of Britain?

12. Trace the important steps of the Industrial Revolution in England.

13. Wherein was the great significance of the invention of the steam engine?

14. Trace the growth of British manufactures.

15. Name and explain the chief features of British foreign trade.

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CHAPTER XXVII

RESOURCES OF THE BRITISH EMPIRE

The four great divisions of the British Empire are Canada, with an area of 3,729,600 square miles; India and dependencies, with 1,802,600 square miles; Australia, including Tasmania, with 2,974,500 square miles; and the Union of South Africa, with 473,000 square miles. But in addition, Britain controls numerous smaller lands scattered throughout the globe. The dependencies in America, for example, include the Bahamas, Barbados, Bermuda, British Guiana, British Honduras, Jamaica, Trinidad, and the Falkland Islands, not to name them all. Some of the dependencies in Africa are Bechuanaland, Gambia, the Gold Coast, Mauritius, Nigeria, Rhodesia, Somaliland, Tanganyika Territory (formerly German East Africa), Uganda, Zanzibar, Pemba, and the Anglo-Egyptian Sudan. These are held in various relations, such as colonies, crown colonies, protectorates, etc. It has long been the policy of Britain to encourage the people of the Dominions to learn to govern themselves, and this plan is carried out with respect to colonies and dependencies. They are expected to do this in an orderly way, and in a manner which does not interfere with the generally accepted canons of morality and justice. When one considers the great diversity of peoples, and the number of stages of civilization which are comprehended within the Empire, it is remarkable that it holds together; yet, as a rule, it functions without serious difficulties.

THE BENEFITS OF EMPIRE

In theory, at least, in matters of broad, general government, the goal is the good of the whole empire, and the great divisions seem to be taking this point of view, although at times the principle is difficult to apply on account of the local sacrifices it may entail. Possibly, in idealistic moments, when not too much concerned with practical matters, the home government regards itself as the trustee of the vast empire, and aims to administer matters as all good trustees ought to do. Thus it has been said: "Many Europeans, especially in England, learnt to regard empire as implying not domination, but trusteeship of two kinds; the first, which is now recognized more or less by all civilized empires, is trusteeship for the backward races they contain; the second, which so far is only recognized, and not very definitely, by the British empire and the United States of America, is trusteeship for the rest of the civilized world." [1] It is certainly true that British statesmen have at times regarded empire as something of a disadvantage, as when Disraeli spoke of the colonies as "millstones about our necks."

But that there is practical advantage in empire, if properly administered, no one can deny. In many instances the benefits arise out of conditions which usually escape attention, as for example, the maintenance of peace and order throughout the Dominions—a condition which is most conducive to the rise of industry and to the prosperity of trade. To lift backward peoples to higher standards of living is to make them more effective producers and larger consumers; and to promote stability of political conditions is to encourage the investment of foreign capital, the development of resources, and the supply of the various facilities which make possible economic expansion. A nation which actively engages in the development of its dominions links their economic organization with its own, and gains a hold on dominion commerce and industry which cannot be easily shaken off. There is great advantage in possessing controlled points throughout the world, however small, which may serve as coaling and oiling stations, and as bases for a system of communication, and which also may serve as safe depositories for goods destined for distribution in tributary areas. And something can be made of the idea that a people is not the absolute owner of valuable resources which may be contained within its confines, but that it is only a trustee of those resources to be used for world benefit, including its own.

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[1] J. P. Bulkeley, *The British Empire,* p. 188.

Great economic advantages come to nations which administer dominions for the purpose of development; but these advantages are ephemeral because, in time, the units of the empire become of age, and develop in ambition to manage their own affairs in their own way. Some of the units of the British Empire seem to have reached this stage today, and we are forced to ask: What are the ties that bind the parts together? The answer is that the ties are invisible things which no man can see, and very few can understand, but they probably consist in some cases of a sense of common nationality, imperial prestige, an idea of common advantage, protection against aggression, desire for stable institutions, the momentum of the old relations, and possibly fear of the consequences in the event of dislocation of present relationships.

That the larger elements in the Empire now have a sense of common proprietorship in imperial business is shown by the sentiments expressed at the various colonial conferences. The first of these were held in 1897 and in 1902, and since the latter date they have become periodical. The outcome for imperial administration is still uncertain. Thus, "many people welcome them as a first step towards an Imperial Parliament, but the colonial representatives insisted, to quote the oft repeated words of the late Sir Wilfred Laurier, the Canadian Premier, that 'this is not a government but a conference of governments.' English opinion in those days generally endorsed this view, though a strong party grew up, under Mr. Chamberlain's leadership, in favor of an Imperial Parliament and true imperial federation."[2]

AUSTRALIA AND NEW ZEALAND

We have discussed in a former chapter the resources and development of Canada. In view of its great forest, field, and mineral resources, this country is one of the richest of the Dominions. The immediate prospects of Australia and New Zealand lie more largely in the development of agricultural industries, although the former region is promoting manufactures. One great difficulty is the relatively small amount of coal. The supply has been estimated at 2,200,000,000 metric tons; that of New Zealand is about 985,000,000 metric tons. Although this is enough for present industrial needs it would not support for many years any considerable expansion of the industries based on coal. Mining is carried on at Maitland, Newcastle, and Lithgow in New South Wales, and at several places in Queensland, Tasmania, and Victoria. Australia contains large supplies of copper, and produces to some extent (13,000,000 tons in 1925), but at present competition with the highly organized industries elsewhere in the world discourages extensive development of these resources. Deposits exist in the Cloncurry district in Queensland, in New South Wales, in Tasmania, and the metal is widely distributed in western Australia. Lead is an important resource in New South Wales, Tasmania, and Queensland, and tin is obtained from Tasmania.

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[2] *Ibid.*, p. 206.

The discovery of gold at Bendigo Creek, Victoria, on December 10, 1851, marked the beginning of a gold rush, and within a short time 50,000 persons were settled in this region. Other important deposits exist in the continent. Gold was discovered near East Coolgardie in western Australia in 1892. The metal was found in New South Wales in 1851. In most cases, the cream has been taken from the original resources and the industry has settled down to the steady grind of extracting metal by mechanical processes. In 1925 Australia produced 675,000 fine ounces of gold as compared with the total for the world of 19,026,000 fine ounces. This same year Australia produced about 4 per cent of the silver of the world. The continent also contains deposits of the lesser minerals such as antimony, molybdenum, and tungsten. Most of the mineral resources, however, are of more importance for future than for present use. Their development depends on the future supply of capital and labor, but much more upon the state of competition from other producing areas.

Greater possibilities for the immediate future lie in the agricultural industries, although the great distance from large consuming markets is a handicap. The Americas still contain great unexploited areas for stock raising and for the production of cereals. They are nearer the markets and therefore enjoy an advantage over possible producing lands in Australia. But, as we have already indicated, this continent is a large producer of wool, and the capacity for production may be greatly increased. Much of the continent is today unfit for agriculture of any description, but by use of irrigation from artesian wells in some localities, and from the streams in others, considerable tracts have been reclaimed, and the possibilities for the extension of such works have by no means been exhausted. Australia exports wool, which amounted to about 41 per cent of the total export in 1925, wheat which amounted to 22 per cent of the total, and butter, beef, wheat flour, gold, silver, copper, lead, and zinc. The eastern and northern portions of the continent contain important timber resources.

Possibly French, Dutch, Spanish, or Portuguese sailors may have stumbled on Australia as an incident of their various trading expeditions, but if such discoveries occurred they yielded no results. The explorations of Captain James Cook marked the real beginning of European interest in this land. In 1771 he discovered "Australia's inviting and well-watered east coast, and gave to the world scientific and accurate information which led to its systematic settlement."[3] The continent was too far distant to excite any particular interest in settlement. Moreover, with Europe in a warlike attitude there was little time to think of colonization. One of the early settlements was at Port Jackson, founded as an English penal station. The settlement retained this character until about 1839, when the government virtually gave up the transportation of criminals to the colony. The years before 1850 were particularly notable for the exploration of the interior. The gold discoveries of 1851 gave a great incentive to migration, and since that time there has been a steady, although not a large migration to this part of the world. In 1921 the population of Australia was only 5,400,000, and that of New Zealand by a census of 1926 was only 1,400,000.

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[3] *Ibid.*, p. 85.

Migration to Australia would be much larger, and many of the waste places would be settled, if Australians looked with favor upon the immigration of Asiatics. These other citizens of the Empire claim the right of free entry into other divisions, but the home government does not interfere on the principle that the colonial governments have a right to determine their own destiny. As reasons for opposition of Asiatic immigration the Australians urge that this influx would lower wages and "destroy the fruits of all their past social experiments, and once for all prevent Australia from reaching the object of her social legislation, i. e., a community of which every member is an educated person, with a fair amount of work, a fair amount of leisure, and a fair wage sufficient for comfortable existence, and the rational pleasures which education teaches a man to expect and enjoy."[4]

As this statement suggests, Australia has been a kind of laboratory for social legislation. The ideals of the country are also contained in this statement. Legislation has concerned not only immigration, but methods of settlements of industrial disputes, tribunals for the adjustment of wages, control over land ownership, the introduction of protective tariffs, and control of railroads. Of the 25,300 miles of line in 1925, 1,730 miles were operated by the federal government, and 23,600 miles by the several states. The future of these plans is not altogether certain. While these measures may be called a national policy, it would require a great stretch of imagination to say that even all the leaders agree with it. For one thing, it has not prevented unemployment, which fluctuates from year to year with changes in business conditions. In June, 1926, 7.1 per cent of the membership of the trade unions were reported as unemployed. Nor has the policy prevented strikes. The enormous debt of national and state governments is largely due to this policy; but a considerable portion of this debt is involved in productive enterprises, and the wisdom of such expenditures depends on the success of the public administration. In 1926 the public debt of the Commonwealth was £458,443,000, and that owed directly by the several states was £584,703,000;

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[4] *Ibid.*, p. 108.

that is, the total per capita debt of the Australian people in 1926 was about $860.

The value of manufactures in the Commonwealth in 1925 was $1,775,000,000, and some 439,000 persons were engaged in the factories. In recent years, Australia has encouraged the investment of foreign capital in manufacturing plants with some success. In 1927, for example, it was said that a number of British and American firms had begun business in the country.

Due chiefly to the growing agricultural exports the foreign trade has expanded greatly in the last twenty-five years. Combined exports and imports for the five-year period ending with 1905 averaged $428,000,000 annually; the total commerce in 1926 was $1,441,000,000.

THE UNION OF SOUTH AFRICA

The Union of South Africa is probably best known to the outside world as a source of gold and diamonds, this region being the largest world source of both these commodities. In 1926 they amounted to 58 per cent of the export trade of the country. But the Union is also one of the chief sources in the world of export wool; shipments in 1926 were 18 per cent of the total exports. But foreign shipments include also hides and skins, angora hair, wattle bark, and, until recently when the change in styles nearly destroyed the business, ostrich feathers were among the important exports. With respect to local conditions, the prosperity of the Union depends largely upon agriculture, but gold, diamonds, and wool largely provide the means for purchases abroad, and for the payment of the various invisible services of industry and commerce.

The Dutch were the first to settle in this region, in 1652, as an incident of their trade with the East Indies. The settlement was maintained at the Cape as a means of supplying sailors on their long voyage to the Eastern possessions. The settlement was augmented in 1689 by the immigration of French Protestant refugees, and occasional migrations from Holland added something to the population of the colony, but growth was slow for more than one hundred years. In 1795, during the European wars, the British took possession of the Cape, but returned it to the Dutch at the Peace of Amiens in 1803, and retook it when war broke out again in 1806. From that time until the formation of the Union in 1910, the history of the colony was a record of almost continuous struggle with native tribes, and with disputes between Dutch and English. The Boer War (1899-1902) was one of the last chapters in this struggle. The constituent parts in the Union are the Cape of Good Hope, Natal, Transvaal, and Orange Free State. The Union is unlike the Commonwealth of Australia, which is a loose confederation of states, with respect to the fact that authority is strongly centralized. The divisions do not have separate governors, and the Union Parliament is in most respects the governing body. The purposes of this organization were "to end the intercolonial squabbles about customs and railways, to work out a consistent and just 'native policy,' more security from English interference than the action of the Natal colonial Government had proved, and to face the difficult question of Asiatic immigration." [5]

The most active industrial interest is in the exploitation of diamonds and gold. The first diamond discovery in 1867 was followed by others, and in 1871 by the discovery of the Old De Beers "New Rush." Gold was discovered in the low range of hills, known as the Witwatersrand in 1885, and was followed by the usual rush Johannesburg sprang up almost overnight. These resources have attracted a large amount of foreign capital and have been responsible for immigration of both European and native labor. Exploitation has contributed materially to industrial growth in the Union, and, of course, has added greatly to the prosperity of the foreign trade. In addition to gold and diamonds, the country produces some copper, tin, and iron. This section is one of the principal sources of corundum, and it often ranks along with Canada (Quebec), Rhodesia, and South Australia in the production of asbestos.

The population of the Union in 1926 was 6,900,000, of which about one-fourth were Europeans. From the point of view of foreign trade the Union and Egypt are the two most important divisions of the continent. In 1926, the combined exports and imports of the Union were $691,000,000, and the gross output of manufactures was about $388,000,000. All but 500 miles of the total of 12,400 miles of railways are controlled by the Union government.

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[5] *Ibid.*, p. 182.

Under one form or another Britain controls a large amount of territory in the southern portion of Africa, and these lands contain many valuable resources. Rhodesia is noted for its mineral wealth, including gold, silver, copper, chrome iron, and lead. At present Basutoland and Bechuanaland are engaged mostly in stock raising. Tanganyika Territory, 365,000 square miles, formerly under the rule of Germany, as yet has received little development. Among others, it produces rubber, sisal, cotton, rice, sugar, and coffee. Zanzibar and Pemba, off the southeast coast of Africa, produce an important part of the world supply of cloves.

At the great bend in the west coast is Nigeria, a region about three times the size of the British Isles. The mineral resources have not been explored, but the area is known to contain considerable deposits of tin, iron, and coal; and it is now an exporter of cacao, rubber, palm oil, palm kernels, peanuts, and hides. Production of cotton has been increasing in recent years; under favorable market conditions, and without too severe competition from other parts of the world, Nigeria could greatly increase her crop. The Cameroon colony, which lies to the southwest of Nigeria, is rich in forest products. The Gold Coast is one of the chief sources in the world for cacao, and it produces gold, kola nuts, and palm oil. It contains important timber and mineral resources. The Anglo-Egyptian Sudan, a huge area (about 1,000,000 square miles) along the upper Nile and its branches, gives evidence of great mineral resources. The Sudan is also a great potential source of cotton. The industry has already passed through the initial stages of development. Promotion of the Gezira irrigation project in the region between the Blue and the White Nile has given a notable stimulus to production. In the season 1926-1927 the production of ginned cotton was estimated at 26,000 tons. Agriculture is the main occupation of the natives. Durra, or millet, is the principal food crop, and in some of the remote provinces it now serves the functions of money. The Sudan is a source of real ivory, and to some extent of the vegetable variety, and of dates, peanuts, sesame, senna, and pulp of the colocynth.

Considering the continent as a whole it may be said that, with few exceptions, the mineral resources are little known. We can surmise the nature of the forest products, but can only guess at the extent. Even where European and American enterprise have entered various regions, reliance is mostly on native labor, which at best is of poor quality, and which, as a result, receives a low wage—from a few cents to forty or fifty cents a day. People of the backward races are only occasional laborers, usually requiring the pressure of circumstances to induce them to work, and as a result it is difficult to maintain a working organization, such as is easily developed in the more advanced countries where men and women are accustomed to the steady grind of labor. No region can even approach capacity production as long as industry must rely upon native labor. Moreover, the lack of modern means of transportation is a great handicap in exploiting even the known resources of the continent. Omitting Egypt and the Union of South Africa, there are only 5,300 miles of railway in the whole continent, and this remaining mileage is in the northern sections—Algeria, Tunis, and Morocco. As a matter of fact, at present, the commercial world takes from Africa only what it needs, with the result that the vast opportunities of the continent remain for future development.

EGYPT

With respect to industry, Egypt is not much more than a fertile strip through the desert. By a kind of accident of nature the waters of the northeastern highlands of Africa must seek their outlet to the Mediterranean instead of the Red Sea, or the Indian Ocean, thus creating a long narrow oasis, and breaking the monotony of the desert. The life of some 14,000,000 people depends on the waters of this stream. Of the total area of Egypt, estimated at about 385,000 square miles, the occupied lands comprise only about 12,300 square miles. The large population, therefore, is crowded in a very small area. In fact, the density is about 1,100 persons to the square mile. Since the life of the people depends on the river it has become necessary to provide greater regularity in the volume of the stream than nature customarily supplies. Thus such engineering projects as the great dams of Aswan and Siut have been provided both to increase the supply of water, and thereby extend the irrigable area, and to provide greater regularity of water supply. The Aswan works now store about 2,500,000,000 cubic meters of water. The Egyptian government proposes to reclaim further areas, partly by draining the Sudd, and partly by increasing the water supply along the Nile. The Gebel Awlia Dam, which was to add to the cultivable area, has been temporarily abandoned, but the government now proposes to raise the height of the Aswan project by 20 feet.

Philadelphia Commercial Museum

Primitive irrigation works on the Nile

Egypt produces wheat (37 million bushels in 1926), barley, corn, rice, and beans, and raises cattle, buffaloes, sheep, goats, asses and mules, and camels (171,000 in the country in 1926). As a commercial crop, however, cotton overshadows all other productive activities. In 1926, the exports of this commodity were 82 per cent of the total shipments. Egypt also exports cottonseed and cotton cake. Sugar is an important crop for domestic consumption. In the last several years the Egyptian cotton grower has suffered along with other cotton producers throughout the world from overproduction, and the government has come to his assistance. The plan employed in 1925-1926 was to purchase and store large quantities of the product. This process merely swelled the supplies already on hand at the end of the season, and the purchase policy was abandoned in favor of a scheme by which the government placed large sums of money at the disposal of the banks, which, in turn, made loans to farmers who wished to store cotton in warehouses under the direction of the banks. Overproduction also threatened sugar producers, but this industry received some relief, due to the curtailment policy in Cuba, which incidentally supplies an interesting illustration of the operation of artificial control of price and output.

Besides the agricultural industries, some energy is devoted to the production of phosphate rock, manganese ore, talc, sulphate of magnesia, building stones, clay, and gypsum. The foreign trade of Egypt has expanded during the last quarter century from a total of both exports and imports of $183,000,000 to about $470,000,000. If this rate of increase is less than that of many other countries, it is due mostly to reliance on one export crop which cannot be materially increased. The chief imports are the textile, of which the United Kingdom is the chief source, and fertilizers, tobacco, timber, and some machinery.

Egypt is an independent sovereign state (so proclaimed March 14, 1922), having no connection with the British Empire, except for certain reservations, namely, the security of British imperial communications; the defense of Egypt against attack; the protection of foreign interest, and the retention of British interest in the Sudan. Whereas it appears from this arrangement that Britain has given more than she has received, there is an intangible benefit of great value in the protection of British lines of communication with other British possessions.

INDIA

Some 319,000,000 people of India live on 1,800,000 square miles of territory. In some areas the density of population is more than 800 to the square mile. This enormous population largely supplies itself from native production. In 1926-1927 the wheat crop was 330,000,000 bushels, barley about 120,000,000 bushels, and rice over 2,347,000,000 bushels. These cereals, together with corn and millet, are the chief mainstay of the people. The crops of India also include sugar, cotton, jute, opium, indigo, tea, oilseeds and tobacco. Cattle supply milk and hides, and in many instances serve as draft animals, and sheep supply the domestic population with wool. Exports are fairly well diversified, including cotton, jute and its manufactures, grain, pulse, flour, various oilseeds, and nuts.

After many centuries of mining, India is still a producer of gold and silver. The mines of Burma yield the greater part of the world's supply of rubies and sapphires. Burma also produces tin and petroleum. The mines of India yield lead, iron ore, manganese, tungsten, chromite, mica, and jadeite. Coal and iron, however, are not abundant, and are poorly distributed for extensive use in industries.

Vast quantities of goods are still produced in India by the hand-labor system, and since earnings are small and the greater part of the population is poor, rigid economy is necessary to make both ends meet. During the last two decades, however, there has been notable improvement in social conditions. Factory production has made some progress with the aid of protective tariffs, and assisted occasionally by bounties, as with paper and iron and steel. Manufacture of coarse cotton textiles has become well established at Bombay, and manufactures of jute are an important enterprise in Calcutta. In 1921 about 433,000 persons were employed in the manufacture of cottons and about 310,000 in the jute-manufacturing industries. British capital is engaged in both these industries, and in the last two or three years Japanese capital has been invested in the cotton industry. India is at present one of the principal markets for British cotton goods, and some persons profess to believe that the rise of the Indian factory system will not only threaten British sales within the country, but eventually may become a factor in the export market of the Far East.

With some 38,500 miles of railways one would scarcely say that the country is adequately supplied with transportation; but these lines have conferred at least one great benefit upon the country, namely, they have relieved somewhat the dread of famine by making it possible to transport quickly the surplus of one region to others which are in need.

The entry of British traders into India dates back to the last years of the sixteenth century. The earliest contenders for this traffic were the Portuguese and then the Dutch. Ships sent out by the East India Company visited Surat in 1608. English trade in Madras began as early as 1639. Then followed the development of trading influence in the Calcutta and Bombay areas. The French, meanwhile, had established themselves at various points in India. The French were practically eliminated by 1763. We are not concerned with the struggles of the East India Company in expanding its control, nor with the system of administration, except to point out that

> the Queen's proclamation of 1858, often called the Magna Charta of Indian liberties, announced that she had taken on herself the government of the Honourable East India Company's territories, and appointed Viscount Canning "to be our first Viceroy and Governor-General in and over said territories, and to administer the Government thereof in our name, and generally to act in our name and on our behalf, subject to such orders and regulations as he shall from time to time receive through one of our principal Secretaries of State."[6]

The present relations of the various Indian governments to that of the United Kingdom are by no means simple—a complexity which partly grows out of their relations to each other. The King of England is Emperor of India. The contact is established through the Secretary of State for India, who is a member of the cabinet of the United Kingdom. The legislature of India is made up of a council appointed by the Crown, including the governor general, or viceroy, and of a legislative assembly which is an elected body. In addition to the British contact, various states and agencies have relations with the Indian government.

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[6] *Ibid.*, p. 148.

OTHER FAR-EASTERN DEPENDENCIES

Under one form or another, Britain controls a vast number of islands in Oceania. The area is large, in the aggregate, and potential production is in keeping with the size. But in most cases, production is in the hands of the natives and no effort has been made to provide an organized system of production, nor to stimulate industrial effort. The natives produce a few commodities which the external world will buy and in this manner supply the means of payment. Fiji comprehends some 250 islands. The products consist of sugar, molasses, copra, breadfruit, and plantains, and the various islands have considerable possibilities for production of rubber. British Guinea yields gold and copper, pearls, coconuts, sisal hemp and rubber, and large quantities of yams and bananas are grown for native consumption. The Friendly Islands produce copra, kava, fungus, and candlenuts.

In Asia, Aden is of chief value as a coaling station and as a depository for transient goods. British North Borneo is the source of timber, rubber, tobacco, rice, spices, sago, camphor, and coconuts. The forests of Ceylon are a source of ebony and satinwood; the pearl fisheries are important, and the island is also a producer of coffee, cinnamon, vanilla, tobacco, and areca nuts. Hongkong is an important commercial, and to some extent, a manufacturing, center. Mesopotamia (Irak), covering about 143,000 square miles, is a land of great industrial possibilities. It has attracted great attention in the last four or five years on account of its petroleum resources, and because of the struggle of a number of the great companies for entrance into this field. The Turkish Petroleum Company and the Anglo-Persian Oil Company are at present the concessionaires. Systematic prospecting did not begin until 1925, but the surveys indicate extensive resources of petroleum. The Irak also holds out great promise for cotton production. Experiments begun about 1917 show that the quality of Irak cotton compares favorably with that produced in other parts of the world. Wool is exported to some extent, the chief producing areas being the Mosul region and the Kurdish hills.

Prior to the late War the chief exports were dates, wool, and barley. For cereals, the population subsists mainly on a variety of wheat known as the Round Mosul, and on "red" rice, an inferior variety grown in the swampy regions of the middle Euphrates. Mosul tobacco is grown for local use. The region produces also millet, licorice root, gallnuts, gum, and dye roots. Military operations of 1914 to 1918 brought the Irak under British control. Immediate political control is in the hands of an Irak government, in which the King is advised by a British high commissioner, and there is attached to each ministry a British adviser.

The War was responsible also for another interesting shift of control, namely, in Palestine. By a mandate, effective September 29, 1923, this country was brought within the sphere of British interest. The local government is assisted by a British high commissioner, with the condition that the government of the United Kingdom possesses veto powers. The government administers about 10,000 square miles of territory which includes only a part of historic Palestine. The population is about 757,000, of which 590,000 are Moslems. Primitive economic conditions still prevail throughout this area, although a beginning has been made in the introduction of modern methods. Products consist of wheat, barley, durra, lentils, and olive oil; raisins, grapes, wine, and tobacco are also among the products. A recent commercial undertaking has proposed to extract the various salts from the Dead Sea.

In some cases, British influence in the Federated Malay States dates back to the régime of the East India Company, but in some instances it is more recent, arising mainly out of troubled internal conditions and desire for stable government. In 1895 the rulers of four states signed a treaty in which they agreed to form a federation to be administered under the advice of the British government. The population of these states in 1921 was 1,324,000, of which 494,000 were Chinese. Tin and rubber are the chief exports. Gold and wolfram are often mined with tin, and there are indications that this area has produced the precious metals for centuries. Production includes also rice, coconuts, gambier, pepper, and coffee.

THE STRAITS SETTLEMENTS

The early history of the Straits Settlements is interwoven with the trading enterprises of the Portuguese and Dutch. Malacca was in Dutch possession until 1795 when it was taken by the British, but was restored to Holland in 1818. It was exchanged in 1824 for the British settlements in Sumatra. In the days of the Oriental traders Malacca was a great entrepôt for products gathered from the Far East, and it retained something of this importance for the products of the Malay Peninsula even after the traders pushed into other islands of the East and to China. In 1786 Penang became a greater center. Trade was carried on from this new settlement with the Malay Peninsula, Sumatra, China, Borneo, and the Celebes. With the establishment of Singapore, much of the trade was transferred to this place; the development of the resources of tin and rubber have contributed in particular to the commercial importance of this place, and because of the commercial organization built up in connection with these commodities, Singapore is also able to handle many other products.

The Straits include a number of island settlements such as Singapore, Penang, Malacca, the Dindings, and Christmas Island, not to mention them all. The population of Singapore in 1921 was 425,000 and of Penang 304,000.

For the purpose of encouraging trade the government has wisely provided that the ports shall be free from export and import duties, except for petroleum, liquors, opium, and tobacco, and no tonnage duties are levied for general purposes. Vast quantities of goods are assembled for shipment, such as coffee, canned pineapples, sago, spices, tapioca, tin, rubber, copra, gums, and rattan. European and Oriental goods are also passed through the ports on the way to ultimate destination.

The greater part of the lands under British dominion are still in a primitive stage of development. The human resource is of less significance than the material factors. For the most part the people are occasional workers, and are unable to perform the tasks of labor in an orderly and systematic way even under close direction. Wages and incomes are small, and for this reason purchasing power is small in proportion to population. In many of the regions there is only the merest beginning of an educational system. In fact, it has been found difficult to administer even the rudiments of learning to people who have never had an educational background. In many cases, the work is rendered more difficult by the existence of a number of tongues more or less characteristic of a locality, and vernacular schools are necessary to meet this problem. The commerce of the world has only small need of the products of many of the regions, and foreign capital has not been introduced either for the purpose of building railways or for the establishment of industries. Something of the capacity of these regions for production, when the real need arises, may be obtained from the great production of rubber under an organized system of direction.

QUESTIONS

1. Are colonies an asset or a liability? Give some evidence.
2. "Great economic advantages come to nations which administer dominions for the purpose of development." Explain.
3. What are the leading resources of the larger parts of the British Empire?
4. Under what handicaps does Australia labor in the development of her agricultural resources?
5. What are the handicaps in the development of foreign trade in agricultural products?
6. Why does not Australia which is a large producer of wool develop extensive woolen manufactures?
7. Discuss the policy of labor legislation in Australia.
8. What are the chief exports of the Union of South Africa?
9. Trace the development of this area.
10. To what extent is the Union dependent for its development on (1) immigration of Europeans; (2) investment of capital from outside?
11. To what extent is the problem of development in much of Africa related to the question of adequate labor supply?
12. What are the chief industries of Egypt?
13. Discuss the recent Egyptian method for the control of surplus cotton.

14. Why do the people of India still labor largely by hand methods? Why do they not introduce large-scale manufactures to supply the large population?

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CHAPTER XXVIII

RESOURCES AND DEVELOPMENT OF GERMANY

Germany is one of the best endowed nations of Europe with respect to industrial materials, and at least since 1871 her policy has been to conserve and to develop those which she does not possess in sufficient abundance, as with the timber supply and the infertile lands. As with many of the other nations, the enormous draft on raw materials, particularly since 1880, has made her more and more dependent on the outside world. This is the case with some of the minor industrial metals and with textile fibers. Germany, however, entered upon the development of factory industries relatively late. Britain enjoyed the advantages of an early start, and France was outstripping Germany up to about 1880.

BACKWARD STATE OF INDUSTRIES

England had the advantages of the new textile machinery, of the early introduction of power devices, of shipping to handle her commerce, of world-wide financial connections, and of a well-developed commercial and industrial organization. Years of preparation are necessary before a nation can make the most of its opportunities. Capital is required both for commercial and for investment purposes; rapid industrial progress postulates experience in manufacturing and trading; and what is equally important, the building up of a machine system of production requires the prior development of a machine-manufacturing industry, and skill in this line is particularly necessary if industries are to be adequately supplied with technical improvements. The slow start was due in large measure to deficiencies of this description.

But Germany experienced other handicaps. Actual wars, and preparation for wars, absorbed an unusual amount of time and resources of the people. Years of absorption in political matters turned the attention of leaders away from industry and trade. Even partial confederation was not achieved until 1867 with the formation of the North German Union, and four years later, in the midst of the Franco-Prussian war, the southern states became members, making the Union complete. Prior to this event, the political struggle among the different states, the presence of different standards of weights and measures, lack of uniformity in the currency systems, and, for many years, tariff walls which prevented the free flow of goods from one part of the country to another were serious handicaps. This condition was partly responsible for the slow development of water-ways and railroads; the absence of a free market extending throughout the country deprived the German states of a great advantage which was enjoyed by England and the United States. It is notable, also, that although in subsequent years Germany contributed thousands of emigrants for settlement in other parts of the world, she had little or no part in exploration and discovery, in the founding of colonies, and in the building up of trade beyond her borders. Colonial expansion proved to be a great industrial stimulus to other countries, partly by focusing attention on matters beyond national borders, and partly by enforcing a policy of overseas and local development for the purpose of finding more markets, and new sources of materials.

RESOURCES OF GERMANY

The country possessed many of the resources needed for the development of manufactures. Timber supply was ample, at least in the earlier years of expansion. With an area, in 1914, of over 208,000 square miles there was abundant space for the development of agriculture, and the application of scientific methods enhanced the productivity of much of this area. The existence of such rivers as the Rhine, Elbe, Oder, Weser, Vistula, and the Danube gave the country a good natural means of communication—a condition which was improved subsequently by deepening and canalizing some of the streams and by connecting several of the rivers by canals. In later years, the construction of the Kiel Canal cut off many hours of troublesome navigation between the Baltic and the North Sea, and the more recent construction of the Dortmund-Emden Canal helped to direct traffic to the northwest sections of the country.

The mineral resources were also abundant. These included the most essential materials, coal, iron, copper, zinc, lead, potash, and salt, to say nothing of a considerable variety of quarry materials. Germany produced considerable quantities of silver (5,600,000 fine ounces in 1910), and a little gold.

Coal is the most abundant resource. The deposits in the basin of the Ruhr are the most important. Estimates about 1870 placed these reserves at about 45,000,000,000 tons, which at the prevailing rate of consumption would have enabled these mines to yield coal for nearly 2,000 years. The Saar field was also one of the most important. These resources, about 1870, were 45,400,000,000 tons. Other fields are found in Upper Silesia between Austria and Poland, containing 50,000,000,000 tons. And there are other smaller fields. Subsequent surveys have not materially altered these early estimates. Germany today is said to contain about 416,000,000,000 tons of coal, which is a much more ample reserve than is contained in any other European country.

Mining was carried on to a limited extent before the end of the nineteenth century. But German miners labored under the same difficulties as those in England, namely, trouble with water in the mines, and with hoisting and conveying the heavy material. Steam power was needed here, as in England, to make extensive exploitation possible; and, of course, the miners needed a market for their product if the mines were to be developed on a large scale, and such markets did not exist until at least 1850. In 1848 production was only about 4,300,000 metric tons. The draft upon coal was greatly augmented after 1870, with the founding of many new industries and with the expansion of the transportation system. Production in 1875 was only 37,400,000 tons. It was 145,300,000 in 1926, and in addition, in that year Germany produced 140,000,000 tons of lignite.

Because of the various shifts in territory brought about by the late War, Germany has lost control over some important resources. The Saar mines passed out of her control, and in the east, a portion of the deposits in Upper Silesia were awarded to Poland. Since a portion of the Ruhr area had been developed in connection with the iron ore from Lorraine, the loss of this territory is at least a temporary disadvantage to the coal industry of Germany. We have already seen that one result of this change has been the further development of the deposits of lignite.[1]

In the case of iron ore, the potential reserves of Germany are considerably less than those of some other European countries, possibly not more than 255,000,000 metric tons. Moreover, there are other disadvantages. Some of the deposits are at a considerable distance from coal, and much of the ore contains phosphorus. In the case of some manufacturing centers it is of more advantage to import ores than to depend on local supplies, and import is necessary also for the purpose of mixing with local ores. In 1913 Germany imported 17,300,000 tons of ore and slag, and in 1926, importations amounted to 11,300,000 tons. Germany, like the United Kingdom, depends on Sweden and Spain for certain kinds of ores, and she also imports from her neighbors, France and Luxemburg. The loss of Lorraine and a portion of the Silesian deposits, as a result of postwar readjustments of territory, renders Germany more dependent than before on foreign ores. In the production of pig iron Germany experienced its greatest expansion in the two decades from 1880 to 1900. The average annual production in the first of these decades was about 3,600,000 tons, and in the second 10,500,000 tons. In recent years, expansion has been more notable in the higher forms of iron, such as steel and its many products, including machinery of all descriptions.

Germany produces large quantities of lead and zinc, but supplies of copper since the development of the electric industries, have not satisfied home needs. The country imports both lead and copper from the United States; in 1913, 35,000,000 pounds of the former and 435,000,000 pounds of the latter. In 1925 the imports of lead from America were 107,000,000 pounds and of copper 360,000,000 pounds.

As with the other industrial nations, Germany must look beyond her borders for most of the industrial metals. One notable resource is the great deposits of potash in the Stassfurt area; and perhaps we should add a notable shortage, namely, petroleum. As a result, Germany is one of the largest world importers of mineral oils. Per capita consumption is much less than in the United States, largely because of the small number of motor cars. In 1925 there was one car for every 185 persons in Germany, and at the same time in the United States, one car for every six persons. The shortage of petroleum oils has led to efforts to discover substitutes, as for example, products obtained from distilling brown coal. But such enterprises have not as yet been established on a commercial scale.

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[1] *Cf.* Chapter VII.

GROWTH OF MANUFACTURES

A national industrial policy became possible after the formation of the Empire. For one thing, the country could follow a coherent policy in the development of its transportation system. Railroads were usually constructed with a side glance at military possibilities, but with this exception, prospective industrial needs dictated the location of the new lines and the extent of construction. The first railway line, from Nuremberg to Fürth, was opened in 1835; but development was slow. The lack of central control was a serious handicap, for the construction of lines across state borders always required elaborate treaty arrangements and not infrequently a state tried to drive the best bargain possible. In some instances, routes were not determined by commercial needs, but by some local influence. The self-seeking policy of Hanover, which lay in the path of eastern and western lines, imposed some difficulties in bringing these two sections of the country together. Similar difficulties were encountered by Bremen and Hamburg. Until 1866 there was no railway to connect the former city with the interior. One fortunate result of the imperial arrangements was that it cleared away these embarrassments and made possible the connection of distant industrial centers with direct and adequate lines of communication.

Germany was not the only country which adopted the policy of railroad building by the government, because we in the United

States had an abundance of experience with state construction of roads, to say nothing of state and federal aid. But in Germany, national—or in the earlier years, state—operation became a policy. In Prussia, the original plan seems to have been to trust to private initiative for the lines which were obviously necessary, and for the state to construct lines in places which did not invite private capital. But eventually state operation became the rule.

In 1860, the total mileage of German railroads, including those of Alsace-Lorraine, was 7,195 miles; in 1875 it was 17,061 miles. In 1913 the mileage of the present boundaries of Germany had become 31,529. Under postwar arrangements, for which the Dawes plan is largely responsible, the lines remain the property of the state, but are administered by the German Railway Company. In 1924, there were still nearly 3,000 miles owned by private companies.

The formation of the Empire paved the way for the formation of a national industrial policy. In economic matters both government and industrial leaders began to take more of an international point of view, and became interested in the development of foreign markets, control over distant sources of raw materials, and subsequently, the investment of considerable sums in foreign countries. Even the acquisition of colonies became a part of the national policy, although, because of a late start, there was little unappropriated territory left of any value for developmental purposes.

Although some industries had adopted the factory system before the inauguration of the new industrial régime, the shift from the old to the new system went on at an accelerated pace. Not that the small industries were eliminated, for they remained in Germany, as in the United States, the land of big business. But the significant feature in Germany, as in the United States, was the increasing number of large establishments. Thus, the number of enterprises in 1882 which employed more than 50 persons was about 9,970, and the total number of persons engaged in these establishments was 1,613,200. In 1907 there were about 32,000 establishments with 50 or more employees, and the total thus engaged was 5,350,000.

Some of the large industries were in iron and steel, with the Krupp works at Essen as an outstanding example; in the new electrical industries; in the manufacture of machinery and chemicals. Another aspect of this development is revealed in the extent of power used in mining and manufacturing, which increased over 120 per cent in the years from 1907 to 1925. In the last twenty years the growth of use of electrical power devices has been remarkable—from 1,500,000 h. p. in 1907, to 11,408,000 h. p. in 1925. But Germany is also a large exporter of electrical machinery. Shipments of electrical machinery in 1926 were valued at $84,000,000. The business is now largely in the hands of the Allgemeine Elektrizitats Gesellschaft and the Siemens-Schuckert Company. It was claimed prior to the War that one of the features of German economic penetration was control over foreign power sources, particularly in near-by countries.

German State Railways

Iron works in the Ruhr, Germany's great industrial region

The high development of the electrical industries is partly due to the fine system of technical education, and this applies also to the chemical trades, which are among the features of industrial growth in Germany. Until the outbreak of the War her position in the manufacture of chemical dyes was unchallenged. Some of the groundwork for the aniline-dye industry was laid by a young English chemist, later Sir W. H. Perkin, whose purpose was not the production of dyes, but synthetic quinine. The valuable suggestion contained in the experiments of Perkin were not followed up by English chemists but were subsequently developed in German laboratories. In the field of discovery one never attains his goal directly, but by patient trial of one thing after another, frequently following false leads, and trying again until desired results are attained. This has been the routine in the discovery of the aniline products. The only way outsiders can discover the secrets of manufacture is to travel the same patient and laborious process of experiment; and a thorough background of chemical education is necessary before this can be done. Germany also attained success in the manufacture of heavy chemicals and many pharmaceutical products. In 1926 the chemical group supplied the country with one of its most important exports, amounting to about $236,000,000.

The textile industries, particularly cottons, rank among the most important enterprises. Over 1,100,000 employees were engaged in these industries in 1925. Cotton manufactures are among the principal exports. Germany must rely on the outside world for the raw material, the United States being one of the chief sources of supply. Germany is also a large importer of jute, wool, and raw silk. In 1926 this country possessed about 10,400,000 spindles for the spinning of raw cotton. While this was less than one-fifth the number in the United Kingdom, it was greater than any other country in Europe.

The building up of a merchant marine was a part of the plan for expanding foreign commerce and Germany engaged heavily in this line of business, possessing in 1913 the largest overseas tonnage of any country in the world except the United Kingdom. A considerable portion of this equipment was built up under the subsidy plan, but it produced a handsome revenue, estimated in

1913 at 540,000,000 marks a year. The rapidity with which Germany supplied herself with this kind of commercial equipment is shown by the fact that the merchant tonnage in 1894 was only 1,785,000 gross tons; in 1913 it had grown to 5,082,000 gross tons.

Another indication of the nation's growing industrial power was in the increasing surplus for investment abroad. German investments comprehended a wide range of activities; they included not only shipping, but plantations, mining enterprises of various descriptions, power sites, and industrial plants. Large sums were placed directly in branch banks, or agencies, and more or less directly, through stock ownership, in foreign banking enterprises. During the War, when many of Germany's activities were condemned by her enemies, such investments were looked upon as a thrust at the independence of business enterprise in other countries. It was said in particular that German capitalists singled out key industries, for the reason that such control dominated not only the particular industry, but all those which were related to it. But as we have seen in a former chapter, there is nothing unusual in foreign investments. Funds from practically all the industrial nations are sent abroad to develop resources, to establish factories, to control mining rights, and in other ways to gain an income for the owners. Economic penetration is a common phenomenon among the industrial nations. Estimates of German foreign investments in 1914 ranged from twenty to thirty billion marks, which was an increase of approximately 200 per cent over the thirty years previous. In 1913, the invisible credits arising from various enterprises, such as interest on capital invested abroad; earnings on German shipping; on foreign banking, insurance, and in mercantile enterprises, was probably from 1,200 to 1,600 million marks. This is in marked contrast with the year 1871 when the country had little interest in any of these enterprises. One of the unfortunate results of the War was the destruction of much of this foreign trade organization. The confiscation of German property in enemy countries and the destruction, or surrender, of much of the merchant shipping, was a severe blow to foreign enterprises generally.

INDUSTRIAL ORGANIZATION

Possibly industrial expansion had been too rapid for the good of the country. Germany was noted for her long commercial credits and for her easy treatment of foreign customers. There is a suggestion in this policy that competition was severe, and that possibly some establishments were oversupplied with producing capacity. At any rate, combination in one form or another, became a policy in a number of industries.

It is an error to assume that all combinations have for their purpose monopoly gain. In some cases they are organized for protection against destructive foreign competition, and upon other occasions against rivalry of a similar kind within a country. There is some reason for believing that in Germany the rise of combined organizations, by whatever name, was in keeping with the spirit of industrial coöperation which has been a dominant characteristic in many gainful enterprises. The buying organization is a kind of coöperative affair, but it is monopolistic in a way, since it brings buyers together for combined purchase and leaves competition on the sellers' side. But whatever the assortment of causes, there can be no doubt that one most potent reason for combinations has been overproduction, as some would call it, or as we prefer to say, an excess of producing capacity.

Germany took up readily with the combination idea after her industries were thoroughly under way; but in modern times combinations had been tried in other countries with varying success. In the United States, the salt producers up the Kanawha River cast their fortunes with combination at least as early as 1835, and attracted the ire of the western farmers who needed salt for the preserving of meat and in the dairy uses. The old Michigan Salt Association of some thirty years later is a familiar theme for study among students of the combination problem. Then followed the Standard Oil Company, blazing new trails, in form at least, although not in purpose.

Among the international cartels "Irma," the International Rail Makers' Association, which appeared about 1883, is said to have been "the grandmother of them all." Some 114 recognized international cartels were said to have been in existence just before the coming of the late War; "that is, there were 114 known to have a habitation and a name, a headquarters, a written agreement, but nobody knows how many other 'gentlemen's agreements', to respect one another's domestic markets had been tacitly reached between competitors who faced each other across national borders."[2] Coal, iron, and steel claimed the greater number; and the list included chemicals and allied industries, shipping, textiles, stoneware and porcelain, paper and pulp, and electrical manufactures. In many of these Germany had a part.

The postwar period has been particularly trying to those nations which expanded producing capacity greatly during the conflict and which, subsequent to the War, have been faced with a market too small to consume the output. This is particularly the case with iron and steel. As early as 1924 there was formed in German the *Rohstahlgemeinschaft* designed to regulate production of iron and steel in Germany. Each month the organization was to state the proportion of capacity for each member. Then, after various preliminaries, there came into existence in 1926 the international agreement in which Germany, France, Belgium, Luxemburg, and the Saar were participants. The agreement contemplated a total tonnage of 25,287,000 metric tons. For the first quarter of 1926 this was allotted in the following manner: Germany, 40.45 per cent; France, 31.89 per cent; Belgium, 12.57 per cent; Luxemburg, 8.55 per cent; and the Saar, 6.54 per cent. A managing committee, made up of representatives of the participating countries, fixed the tonnage quarterly, basing judgment on the probable needs of the market.

In the chemical field in Germany the "dye trust" increased its capital as a preliminary to further expansion. This action in increasing capital from 646,000,000 marks to 1,100,000,000 marks placed it, "from the standpoint of capitalization, at the head of European industrial combinations." The purpose of this increase was to enable the company to branch out into new lines, such as the manufacture of explosives and the production of oil from coal.

During the period of expansion the government has taken a more active part than is the case with other countries. The adoption of protective tariff measures, the subsidy policy in the development of shipping, favors to exporters in the form of rates on the German systems of transportation which enabled producers to enter foreign markets in competition with foreigners, the use of bargaining tariffs to gain a favorable position for German goods, and systems of social insurance which alleviated somewhat the conditions of the workers, were some of the fields of government activity.

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[2] R. Liefman, *International Cartels, Combines and Trusts*, p. 19.

POPULATION

Germany has suffered the common experience of all nations which have undergone industrialization, namely, the concentration of people in the urban communities. In 1925, 64.1 per cent of the people lived in places having a population of 2,000 and over. During the years from 1871 to 1910 Germany added over 23,000,000 to her population—a growth of from 41,058,000 at the former date to 64,925,000 (former boundaries) at the latter. The population in 1925 was 62,508,000. In 1910 there lived within the present city limits of Berlin about 3,734,000 people.

As a human resource, this population possesses unusual qualities for industrial progress. As a rule these traits are capacity for work, thrift, patience, and eagerness for improvement. The splendid system of education has improved these qualities, instruction being adapted to the various needs and ambitions of nation and people. In 1925 there were 22,600 students in the advanced technical schools, and 58,600 in the universities; in 1922, 2,120,000 in the vocational and trade schools, and over 8,894,000 in the elementary schools.

Germany manifests another common feature of all countries in the manufacturing stage, namely, the development of labor organizations. The inception of this movement was almost contemporary with the growth of the factory system, and it now comprehends more workers than in any other country in the world. In 1923 the organized workers numbered about 13,000,000; not all, however, were organized on the same principle. Of the number given above, the groups of socialists comprehended about

9,000,000 members. Notwithstanding this organized activity, wages are relatively low. In 1926 the average weekly wage for skilled workers was approximately $11, and that of the unskilled about $8. Yet living conditions this year were said to have been "far better than at any time since the War, as indicated by higher consumption of both luxuries and staples. People are better dressed and more money is being spent on amusements; at the same time savings deposits have been growing steadily." [3]

AGRICULTURE

Needs for food to supply the growing population have been met in part by an expansion of agriculture. But at that, in 1913, Germany was a large importer of wheat (93,000,000 bushels), barley (148,000,000 bushels), corn, and rice. At times, imports of wheat flour have been large. During the years from 1880 to 1920, Germany added to her domestic production of rye about 4,500,000 tons, and about 800,000 tons to her production of wheat. Competition with foreign countries has been met to a large extent by use of a protective tariff applied to certain agricultural products. Since the needs for additional labor have been satisfied in part, at least, by a drift of workers away from the agricultural areas, the native labor remaining on the farms has not sufficed to do the work. Fortunately, Germany has been able to draw upon her neighbors for laborers for farm work. More or less transient labor has been supplied in increasing quantities from Russia, Poland, and Austria. Just before the War this immigration was estimated at about 500,000. Agricultural coöperative societies have found favor in Germany, although the development has not been as great as in Denmark. In 1926 about half such societies were coöperative credit organizations, or savings banks. Consumers' coöperative organizations have been built up in a number of the rural communities. One of the characteristics of the system is the small credit institutions organized for service to the very small borrower. Raiffeisen organized the first village bank in 1862. He preached the gospel of thrift and mutual aid, and the founding of these banks was a part of this scheme. "The basis of his plan of organization was unlimited liability of members, and has been almost universally followed wherever coöperative banks have been formed. His original idea was that the village bank should be the nucleus of a general-purposes society for buying and selling and other activities of the members."[4] Subsequent development, however, carried the institutions away from some of the ideas of the founder. For one thing, the special coöperative society, organized for some specialized purpose, seems to be better adapted to modern needs, and development has taken this direction.

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[3] *Europa*, 1928, p. 32.

At present, the most important cereal crops, named in order of their rank, are oats, rye, barley, and wheat. Germany was the first country to develop an effective technique for the manufacture of beet sugar, and although for some years France was more actively engaged in the business, Germany is now the most important producer in Europe. The output of sugar beets in 1926 was more than 20 per cent of the total production in Europe. Before the War this country was a large exporter of sugar. Excluding Russia, Germany produces about 30 per cent of the total European crop of potatoes—over 1,000,000,000 bushels in 1926, which, incidentally, exceeds production in the United States. Other crops are fodder beets, hay, alfalfa, clover, spelt, and fruits of various kinds. Stock raising is a leading branch of agricultural enterprise, including cattle (17,000,000 in 1926), swine (19,000,000), sheep (4,000,000), goats (3,400,000) and horses (3,800,000).

THE DAWES PLAN

Germany is the center around which all the plans for postwar European debt settlements revolve. Germany's capacity for payment was once a favorite theme for debate, but the report which accompanied the Dawes plan dismissed the argument with the statement that "experience and experience alone can show what transfers into foreign currencies can in practice be made." The settlement is of vital importance to Germany because it means an enormous annual tax on her enterprises, but it is also of importance to the trading nations because of the effect of such payments on the commerce and industry of Germany and upon international commerce in general.

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[4] *Ibid.*

An unusual feature of the late War was the direct lending by one nation to another. The United States and Great Britain were the chief sources of loans, but Britain was also a large borrower from the United States. During the War and postwar periods, the United States extended loans to some twenty countries. The total indebtedness, including unpaid interest, on November 15, 1923, was $11,800,000,000. Of this $4,600,000,000 stood against Great Britain, $3,990,000,000 against France, and about $2,000,000 against Italy. Most of these countries have now made arrangements for payment, usually on the basis of a stated sum annually to cover interest and a portion of the principal. From the time the contracts were signed these payments were to run for some sixty years.

No doubt most of the debtors expected that the sums would eventually come out of Germany. France, for example, has urged that she cannot discharge her foreign obligations unless Germany makes payment. Recognizing the helplessness of the European countries, Former Secretary of State Hughes intimated in 1923 that the United States would be willing to take part in an economic conference. The Dawes Commission of 1924 was the outcome. Among other things, the Dawes plan provided for: (*a*) the stabilization of German currency by the creation of a new bank of issue with a capital of about 400,000,000 gold marks; (*b*) annual reparations payments from all sources rising from $250,000,000 in the first year to about $625,000,000 in the fifth year, and varying thereafter with the "index of German prosperity"; (*c*) mortgage of German railways for about $2,750,000,000; (*d*) mortgage of certain industrial companies for about $1,250,000,000; (*e*) raising of German taxes to the level of Allied countries; and (*f*) arrangements for the payment of all reparations into the new bank to the credit of the Reparations Commission. To use the word of the commission, the ultimate outcome of this arrangement will be determined by the revelations of "experience."

QUESTIONS

1. Account for the late development of the industrial system in Germany.
2. What are the leading economic resources of Germany today?
3. What disadvantages does this country now labor under in the development of manufactures of iron and steel?
4. What important raw materials does Germany lack? From what sources are these obtained?
5. What policy was adopted in Germany with respect to railway building and operation?
6. What benefits result from the formation of the Empire?
7. State the leading features of German manufactures today.
8. To what extent was Germany becoming an investing country before the War? What benefits did she derive from her foreign investments?
9. What does the phrase "economic penetration" mean? Do capitalists in the United States and Great Britain employ this system? In what ways?
10. Discuss some of the features of German industrial combinations. What is the cause for such combinations?
11. Explain how the cartels operate.
12. Do you think that international cartels are the solution for the problem of excess producing capacity? Why?
13. What was the leading feature of the industrial policy of Germany during the years after the unification? Do you think this was a wise policy?
14. Discuss the qualities of the human resource in Germany.
15. What are the outstanding features in the development of German agriculture?
16. Give the leading features of the Dawes plan.

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CHAPTER XXIX

RESOURCES AND DEVELOPMENT OF FRANCE

In France industrial ideals have been somewhat different from those in Germany after 1871, and certainly different from those in the United Kingdom before and after the Industrial Revolution. Although there are exceptions, trading and organizing instincts were not as strong as in these other countries, and there seems to have been more willingness, at least on the part of the great mass of French workers, to accept present conditions as good enough. For years agriculture was the dominant industry, and even today industrialization has not reached the same stage as in Germany and Britain. France engaged in exploration and settlement, and in colony building, but her people did not migrate as readily as those of other countries. At one time France lost most of her valuable colonies, and temporarily at least, interest in colonization declined, only to revive at a later date. France, today, ranks after Great Britain in extent of colonial empire. Wars and revolutions had their effect in retarding the growth of the factory system and in the accumulation of capital for investment at home and abroad. Capital accumulated much slower than in Great Britain. All in all, conditions have given industry a somewhat different bent than in these other countries, and it exists today with different features, and in different proportions, although the years since the War seem to be marking the appearance of a new industrial era.

POPULATION

One remarkable feature connected with French population is the slowness with which numbers have increased. The annual increase during the years from 1801 to 1876 was very small. It was estimated about 1875 that while the population of England had approximately doubled in the preceding fifty years, about 160 years would be required to achieve the same results in France, taking into account the shifts of territory in 1871. Moreover, numbers have been practically stationary since 1872. In that year the numbers were about 36,102,000, and in 1921 in the former boundaries the population was about 37,499,000. At present the birth rate exceeds the death rate by only a small margin. In the years from 1922 to 1926, for example, the excess of births over deaths was only 70,117. Moreover, only small additions have been made to the population by immigration. In recent years foreign workers have been brought to the country under contract, but the number has not been large, although the acquisitions from this source have been larger since the War. If France is on the eve of a new industrial expansion it is difficult to see how this can take place without drawing large numbers away from the farms, or with the other alternative, the addition of a greater number of foreigners. There seems to be little possibility of a considerable expansion of population through a higher rate of natural increase.

Further, at present, the population is not as highly concentrated in the urban centers as in the other industrial nations. In 1921 only 46.4 per cent could be put in that class, while in Germany the percentage was 64.1, and England and Wales, 79.3 per cent. In fact, the urban concentration is even less than in the United States, notwithstanding our vast agricultural area. If population is not keeping pace with possible industrial needs, France at least is leaving no stone unturned to educate its people. Large numbers of students are taking courses in the industrial, commercial, and agricultural schools, to say nothing of even larger numbers in colleges and universities.

PHYSICAL RESOURCES

As with some other European countries, the timber supply must be carefully conserved. About 19 per cent of France is under forests, and of this land the state owns about 36 per cent. The most important forest areas are in the northeast, the southeast, and the southwest. Wood is largely used as a domestic fuel in France, and even small branches and twigs are used for this purpose. The cork oak is cultivated in southern France, although Portugal and portions of Spain are larger producers. The stand in French forests is mostly oak, birch, elm, pine, beech, and chestnut. France usually imports considerable amounts of wood and wood pulp. We should add to this list fruit- and nut-bearing trees, of which the country contains large numbers, including apples, pears, plums, citron, figs, almonds, chestnuts, and walnuts.

The fisheries are particularly valuable, supplying raw materials both for home consumption and for export. French fishermen carry their enterprises far beyond the limits of home waters, visiting Iceland and Newfoundland. Sardines are taken from the waters off the coast of the Bay of Biscay.

In view of the enormous growth of the iron and steel industry in the United States it may seem a little hard to understand why the older countries have lagged so far behind. In 1925, for example, this country produced more iron ore than the United Kingdom, France, Germany, and Belgium together. The prolific nature of our supply has something to do with it, but from the point of view of consumption the uses for iron in this country are far more intensive than in any country in Europe. Our railway mileage alone, which is more than two and one-half times that of France, Germany, and the United Kingdom, is a great source of demand for products of iron and steel, and during the era of rapid railway building this demand was a great stimulus to American industry. But European countries have been denied the benefits of such markets. In France the demand has been on a much smaller scale than in the United States, not only because of the smaller volume of railway buying, but because demand is less diversified and less intense. The rapid increase in the production of iron ore in France dates from about 1880 when the output was about 1,600,000 tons; it was 21,500,000 tons in 1913 and 39,000,000 in 1926. The loss of the Lorraine deposits in 1871 kept production down in the early years of this period, and the restoration of those deposits as an outcome of the late War has contributed to the increase in French production since that date. A number of deposits are scattered through France, but the most valuable are in the northeastern part of the country, including the territory recently regained from Germany.

In the case of coal, although the resource exists in a number of places, France is not nearly as well supplied with material as the United Kingdom or Germany. But if production has been smaller than in other countries, a part of the explanation lies in the nature of the demand which has not been as diversified, nor as intense, as in other large industrial countries; this is notably the case when compared with the United States where railroad consumption alone is more than twice the annual production of France today, and consumption in industrial plants in this country is more than three times what France produces. Unlike Great Britain, France is more largely an importer than an exporter. French reserves are relatively small, compared with those of Britain and Germany, and eventually France must look forward to much larger importations. Growth of production has been relatively small—from about 16,700,000 tons in 1876 to 57,800,000 tons in 1926.

Nature paid no attention to future political boundaries in distributing resources and the present results are sometimes embarrassing. This is the case with the distribution of coal and iron in western Europe. The iron industry of France must be worked in connection with coal from Germany. Whether iron will move to coal, or coal to iron will depend on the development of certain economic factors connected with both the production and the distribution of coal and iron, including its finished forms. From present indications coal and iron producers in the adjacent countries will work out their problem by some form of coöperation. France, Germany, and Belgium are involved in this problem. As we indicated in the last chapter producers in these countries are parties to the steel agreement of 1926.

France contains only meager supplies of lead, zinc, and copper. In fact, the country is a large importer of copper (260,000,000 pounds in 1926) and of lead (154,000,000 pounds). Potash is obtained from Alsace, and this commodity enters into the export trade. Combination existed in this industry when the resources were largely under German control, and a new combination has appeared joining present French and German interests. By the terms of a contract signed in 1926 organizations in these two countries have agreed to establish export quotas and to fix the price. The contract runs for ten years. Among the other resources of mines and quarries mention should be made of bauxite, building stones, slate, raw materials for cement, and gypsum, the source of plaster of Paris. Sea salt is obtained from salt pans on the Bay of Biscay and on the coast of the western Mediterranean.

AGRICULTURE

Agriculture has always been one of the mainstays of the French people, and it is today one of the leading branches of industry. More than half the people live in the rural districts. Peasant ownership and small holdings are features of French farming. Many of the holdings consist of only a few acres, although there are many large farms in France. Many farms are too small for effective cultivation even under a system of coöperation. The work must be done largely without the use of power devices, and the return for the work done is relatively small. The yield of wheat is low compared with some other European countries. During the five years ending with 1913 the average annual return was 19.7 bushels per acre, whereas in England and Wales it was 31.2 bushels and in Germany 32.6 bushels.

Coöperation among farmers has met with some success. In fact, the coöperative syndicates have undertaken a considerable proportion of the work in restoring the devastated areas. The Agricultural Coöperative Union of France numbers about a million members, and the Union of Dairy Societies in Charente and Poitou has about 75,000 members. In addition, there are a large number of Central Unions of Agricultural Syndicates.

France usually produces more wheat than any other country in Europe, except Russia. The crop of 1926 was 249,000,000 bushels. France also produces a large crop of oats, potatoes, and sugar beets. Rye and barley are of smaller importance. Production of grapes and manufacture of wine is one of the leading enterprises. The grape-producing areas are rather widely diffused—in the valley of the Garonne, for example, in Champagne, Burgundy, and in the lower Rhone Valley. In view of her enormous production of wine France imports a remarkably large amount (276,000,000 gallons in 1926), and exports relatively little (55,000,000 gallons in 1926). It takes no figuring to show the home consumption is very large. Production in the year just given was over a billion gallons.

Office Français du Tourisme

Vintage time in a French vineyard

MANUFACTURES

The development of manufactures has been slow. Growth has not manifested, at least to an imposing extent, the features which characterize industrial expansion in the United States, and to a smaller extent in Germany. Although there are exceptions, French industry has not become one of huge aggregations of capital, of combinations and integrations, of high finance and power selling. Instead, industrial life has followed a more prosaic course. Whether this feature will continue to mark French industrial development remains to be seen. Whatever may be the movement of events in a protected home market, foreign sales are severely competitive and success depends largely on terms, including the price; and the latter depends largely on the producer's cost. With some exceptions, successful foreign selling implies a kind of industrial organization which can meet competitors on the cost basis. A country may be safe for a time in the foreign distribution of quality articles—those which embody skill, art, and taste, but eventually if such goods meet with consumers' approval, competitors come into the field with imitations, usually cheapened by machine production. This has been notably the case with silk, which some fifty years ago France might have claimed as a distinctive industry, but which is now shared with other countries, and with the United States in particular.

Production of fabrics from wool, flax, and silk are old industries in France. The manufacture of cottons, however, as in all other countries, is of more recent date. In an earlier chapter we referred to the introduction of the silkworm into Europe.[1] The introduction of both the silkworm and the mulberry tree into France has been attributed to the first Avignon Pope, Clement V. Until modern methods of production cheapened this commodity, silk was always a luxury and production was encouraged upon a number of occasions by royal favor. The records indicate that the production of raw silk in France increased steadily during the first half of the nineteenth century, and then a great misfortune befell the industry in the form of a pest which attacked the silkworm. At present, France is a large importer of raw silk. Production reached a maximum in 1853 when the amount was 26,000,000 kilograms. By 1872 it had dropped to 9,800,000 kilograms. Lyons has long been the center of the silk industry and trade. The extent of the enterprise is shown by the fact that in

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[1] See Chapter XIX.

1875 there were some 400 firms in the city giving employment to many thousands of workers. The weaving of silk was largely a hand industry until 1860, and even today hand weaving is an important element in the industry.

In 1912 France produced only 505,000 kilograms of natural silk, or a little less than 2 per cent of the total world output. In fact, the share of western Europe in silk production has declined from 46 per cent of the total in 1875 to only 12 per cent in 1925. The Far East now produces about 85 per cent of the total. Japan has been the chief beneficiary of the change, but whether or not this advantage can be retained for any length of time depends upon changes taking place in the artificial silk industry. The origin and methods of diffusion of the diseases which afflicted the silkworm have been understood since the successful experiments of Pasteur, and it is now possible to put the production of natural silk on a scientific basis. But other factors prevent the revival of the industry in western Europe. One, no doubt, has been the great improvements in the manufacture of artificial silk. New processes have made the material noninflammable and resistant to the action of moisture. Manufacturers have learned the art of dyeing the material and of preparing it for use so that it retains its silky luster. With these improvements it has become a serious competitor of the natural product.

But other factors enter into the production of real silk, for "sericulture is a small agricultural cottage industry requiring no special skill or muscular strength. In countries where there is an annual harvest, it meets with severe competition from other industries, *e.g.*, wine growing in France. But where the worms are multivoltive and there are several crops of mulberry leaves annually, it becomes a staple and national occupation, as in China and Japan." [2]

An even greater misfortune than the pests which afflicted the silkworm was the loss of the growing American market for silk. In 1860 this country produced only 13 per cent of the amount it consumed. In 1900 domestic production covered about 70 per cent of home consumption, and this signifies that the manufacture of silk has become one of the leading textile industries in the United States. In fact, in 1925, the total value of silk manufactures was $808,000,000. With the rise of manufacture in the United States imports from France have fallen to very small proportions, as is shown by the fact that we imported only $19,000,000 worth of silk fabrics from this country in 1926.

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[2] *Europa*, 1928. *Cf.* "Silk."

France was the pioneer in the manufacture of artificial silk. The early experiments were performed about 1900 and when the industry began to promise success it was taken up by other European countries. Although the industry in France has continued to grow, Italy has become the most important producer in Europe, followed by the United Kingdom and Germany, and, in 1926, France ranked fourth with an output of 7,500 metric tons. The manufacture has crossed the Atlantic, with the United States now ranking first among world producers with 29,500 metric tons to its credit, equal to nearly 30 per cent of the world total. The raw material from which artificial silk is produced is wood cellulose or cotton waste. A number of methods have been developed for converting these materials into artificial silk yarn, such as the nitro-cellulose, viscose, and acetate processes. Fortunately, these new discoveries came into an industrial world which was ready to supply their needs. Spinning and weaving devices, for example, were highly developed and in a condition to handle the new fiber. Moreover, the chemical industries were prepared to supply in almost any quantity the necessary chemical ingredients required for manufacture. At present, at least a dozen countries manufacture artificial silk. The world production in 1926 was 101,300 metric tons. It might be interesting to observe that production has even gained a foothold in Japan, the present greatest producer of natural silk. In many respects the substitute is superior to the real product, and it remains to be seen whether the days of real silk are numbered, and whether the faithful silkworm which has toiled for royalty for several millenniums and for common people during a much shorter period, is to be given a long rest from its labors.

With woolens and linens as with silk, France acquired a high reputation for its manufactures centuries ago. It was largely

French artisans who had been driven from their home country by religious persecutions who founded the manufacture of the finer qualities of fabric in England, and those who directed the affairs of this country were shrewd enough to provide for the spread of the knowledge of working such fabrics among native-born Englishmen. Production of linens is localized mainly in Normandy, Brittany, and Flanders. The woolen industry is more widely diffused. As a rule the manufacture of these materials has not followed the course in other important textile-producing countries, namely, large-scale industry employing great power devices. Instead, the French industry has remained on a relatively small scale, and in many cases the hand operator still holds his own in industry.

The textiles form an important part in French export trade. Silk fabrics are the most important, followed by cottons and woolens. France now depends largely on the outside world for raw materials for her textiles. She imports large quantities of cotton, flax, jute, wool, and raw silk, her foreign bill for these materials in 1926 amounting to $454,000,000.

France produces a vast number of articles which appeal to the quality demands of people in many parts of the world. French fashions are always somewhat in advance of those of her competitors, who often imitate the commodities which have met with success. The trade name connected with many French commodities is of great importance in maintaining her position in the foreign competitive markets. Such articles include manufactures of wool, flax and silk, leatherware, pottery, glass, precious stones, art ware of many kinds, perfumes, millinery, artificial flowers, and apparel. The Gobelin and Beauvais tapestries and Sèvres porcelain are among the noted products.

SYSTEMS OF COMMUNICATION

Until about 1850 France seems to have paid greater attention to the building of highways than of railroads. The country engaged in a rather extensive plan of road building, including national, departmental, military, and local roads. France also expended large sums in the improvement of rivers and in the construction of canals. Even today these channels carry a large amount of traffic, as is shown by the fact that in 1924 about 36 million metric tons of freight were moved over the internal waterways. Carriage of freight on the railroads the same year was 282 million tons.

Railroad building made slow but steady progress. Possibly the high cost of construction tended to discourage private capital. At any rate, the state granted aid to the companies, but in return exacted a tax in proportion to the traffic. The cost of the 13,600 miles of railway in existence about 1875 was about 10 billion francs. The railway organization of France today includes six private and one state line, together with about 12,000 miles of local railroad—all in all about 38,300 miles.

RESOURCES OF FRENCH COLONIES

French colonies, mandates, and dependencies cover from four to five million square miles with a population of over 50 million. Since these possessions are scattered in many parts of the world they yield a great variety of products, some of which are of considerable value to commerce. But, on the whole, the resources of this empire await future development.

French Equatorial Africa covers some 982,000 square miles; French West Africa about 1,800,000 square miles; Madagascar about 228,000 square miles; Morocco about 231,000 square miles; Tunis, 50,000 square miles; and Sahara 1,544,000 square miles. In addition France governs Somali Coast, the Reunion Islands, Kamerun, and Algeria. Possessions in Asia include Syria, Annam, Cambodia, Cochin China, and small areas in India and China. In America, France still retains of her former great empire Guadeloupe, Martinique, and St. Pierre and Miquelon.

The dominions in North Africa hold out the greatest promise for early development. This fact is recognized by the home government which is encouraging the growth of commerce and industry. The total trade of Tunis in 1918 was 336,000,000 francs. France, the United Kingdom, Italy, Algeria, and the United States were the leading participants, but France enjoyed the lion's share, about 42 per cent of the total. The mineral resources have not been thoroughly explored, but certain kinds of deposits have already been developed to some extent and are supplying materials to commerce. These include phosphates, iron ore, lignite, lead, zinc, and manganese. Countries to the north of the Mediterranean are already drawing heavily on the phosphates; France and Italy are the main consumers, but shipments are made also to Great Britain and Portugal. Because of the needs of Europe there is a prospect for a great development of these resources. Iron ore is exported to Great Britain and to the Netherlands. Manganese has only recently been discovered. The fisheries supply sponges, tunny, sardines, anchovy, sole, lobster, shrimp, and octopus (of which the United States imported over 9,000 pounds in 1918). The forest lands, which are located chiefly in the north and central regions, are controlled by the state. The area is relatively small—some 2,400,000 acres, but the stand contains a number of useful timbers. Cork oaks cover about one-fifth of the total area; scattered through the timber lands are Aleppo pines, evergreen oaks, cedars, junipers and carobs. Of the orchard products, olives are most important, but there are also considerable numbers of date palms, orange, lemon, and almond trees.

Tunis produces wheat, barley, oats, maize, and beans, and its vineyards are of growing importance. Sheep raising could be carried on to a much greater extent than at present; little or no attention has been given to systematic stock raising. The sheep roam at large, feeding on native grasses. Goats, camels, and cattle are a part of the livestock equipment. The raising of pigs could be carried on cheaply on account of the enormous supply of "mast" from the cork forests; but since pork is proscribed by the Moslems little attention is given to swine culture, except by the European settlers. The country suffers from lack of labor supply and from lack of means of transportation; these conditions bear immediately upon a few products for which there is a growing demand. One of these is esparto or alfa grass. This plant grows wild on the hot dry plateaus which have a permeable soil. It has been estimated that cultivation is possible on at least 3,500,000 acres; but, as yet, the industry is in only a primitive condition. Esparto is used in the manufacture of paper and cordage. At present the United Kingdom is almost the only consumer.

Manufactures are still carried on in a crude way, yet they yield a diversity of products, such as fine paper from alfa, olive oil, soap, rugs manufactured from domestic wool, saddlery and other leatherwork, basketry made mostly from alfa, perfumes, rugs, carpets, blankets, and fezzes. Weaving is a hand industry.

Several towns of Tunis are northern termini of caravan routes which lead into the Sahara regions. The Tunisian government has attempted to encourage this traffic by the construction of public wells along the route and by the development of trails.

Jurisdiction in Morocco is divided between France and Spain except for the Tangier zone which is governed in accordance with a convention of 1923 between France, Great Britain, and Spain. French control covers about 85 per cent of the area and population. Hitherto, Morocco has enjoyed the distinction of being one of the most backward industrial regions in the world in spite of the fact that the country is believed to be rich in both agricultural and mining possibilities. Under native control mining was prohibited, and there was no security for life and property. Add to this that the natives are a fanatical semi-barbarian people who look upon Europeans with aversion and one sees why this country has not attracted people of European stock who might have been interested in exploiting its resources.

The country produces barley, wheat, beans, chick-peas, maize, oranges, lemons, dates, and figs. Cork, gums, and phosphates are important products. Recently, under French control, European enterprise has begun to develop some minerals, such as the phosphates and iron ore. The city of Morocco enjoys an extensive caravan trade extending to Timbuctoo on the Niger River. Imports from places along the route include dates from the oases, Sudan ivory, ostrich feathers, and gold dust.

Madagascar is one of the most valuable of French possessions. The island is a little larger than France. The population (3,500,000) is made up mostly of natives with a small intermingling of Europeans (22,600) and Asiatics (10,500). Agriculture is the chief occupation. The island supplies to world commerce vanilla, cloves, coffee, sugar, manioc, butter beans, and mangrove bark.

The French have encouraged the production of cotton, rubber, and tobacco, and they have also been instrumental in promoting the mining of graphite, corundum, and mica.

INVISIBLE CREDITS

As with the United Kingdom, France has enjoyed a considerable income from trade with its colonies, from its ocean shipping, and from foreign investments. In 1913, however, the ocean shipping owned by French interests was less than half the German, and less than one-eighth that of the United Kingdom, namely, 2,200,000 tons. But French investments in foreign countries were a large source of income. Nearly 25 per cent of these funds were invested in Russia, large amounts of French capital were involved also in Turkey, Roumania, old Austria-Hungary, and in Spain and Portugal. Over 4,000,000,000 francs were invested in Tunis and other French colonies, and about 3,000,000,000 in Argentine, Brazil, and Mexico, and this says nothing of investments in Asia, Egypt, and South Africa, which brought the total foreign loans in 1914 to 45,000,000,000 francs.[3]

More than half these funds were in state and municipal loans and most of the balance in railroads, mining enterprises, industries, foreign banking, and insurance and shipping. These foreign funds had accumulated steadily since the close of the Napoleonic wars, slowly until about 1875; and then from that date to 1914 there was a rapid addition to foreign claims. In fact, so much French capital was invested abroad that it was sometimes claimed that industrial opportunities at home were ignored and that the country as a whole suffered from the migration of funds. A comparison of French with German and British foreign operations reveals the following: "Germany has a gross total of foreign investments of about 25 billion gold marks, with an offset of foreign investments in Germany of about 5 billion marks, leaving a net total of 20 billion marks, equivalent to about 25 billion francs. Great Britain's foreign holdings approximated 4 billion pounds sterling, or 100 billion francs." [4]

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[3] Moulton and Lewis, *The French Debt Problem,* p. 22.

[4] *Ibid.*

QUESTIONS

1. Contrast the industrial development of France with that of England since 1800.

2. Why did not France go over to the factory system as promptly as did England?

3. Why did capital accumulate slower than in England?

4. What have been the leading features in the development of French population during the last 50 years?

5. If there is any considerable expansion of French industry in the near future, where will the labor supply come from?

6. Discuss briefly the systems of vocational education in the European countries. How has this helped the industrial expansion of these countries?

7. What is the nature of the fisheries resources in the various countries of Europe?

8. What measures are taken in Europe to conserve timber supply?

9. Why has not the iron and steel industry of France, Germany, and England increased as rapidly as that of the United States?

10. Discuss the forms of agricultural coöperation in Europe. How has coöperation aided in the development of industries?

11. Name and discuss the leading features of French manufactures.

12. What difficulties have been encountered by the French silk industry? Have any industries elsewhere in the world encountered similar difficulties?

13. Trace the rise of the artificial silk industry. What do you think is the future of this industry and that of natural silk?

14. What are the leading resources of the French colonies?

15. To what extent does France derive benefits from the invisible credits?

16. Compare the magnitude (in 1914) of French foreign investments with those of Britain and Germany.

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CHAPTER XXX

RESOURCES AND DEVELOPMENT OF CERTAIN EUROPEAN COUNTRIES

All classifications are more or less artificial, but they serve the general purpose of enabling us to arrive at approximate relations. With respect to the volume of international trade we may place the countries of Europe in five groups. Thus divided, the first group includes the United Kingdom, Germany, and France. In each case the total foreign trade, imports and exports combined, is in excess of $3,000,000,000. We might place in the second group Italy, Belgium, and the Netherlands. In the case of the members of this group the foreign trade is over one billion, but less than two billion dollars. The third group includes countries with foreign trade which ranges from five hundred million to a billion dollars. The countries in this class are Switzerland, Czechoslovakia, Denmark, Spain, Sweden, Austria, and Russia. The fourth group is of still smaller importance with reference to foreign trade, the external commerce ranging from about two hundred million to about five hundred million dollars. The group contains the Irish Free State, Norway, Poland, Hungary, Greece, Roumania, Jugoslavia, and Finland. In the case of the countries of the fifth group the total trade in each case is less than one hundred million dollars. This is the situation with Latvia, Bulgaria, Esthonia, and Lithuania.

THE EFFECT OF POLITICAL BOUNDARIES

One result of the late treaty of peace was the recognition of the racial or national ambitions of certain of the subject peoples of Europe, and the increase in the number of states. In many cases the boundaries are political and not economic. In fact, while the peace adjustments have in a measure satisfied the political aspirations of these various peoples, they have greatly increased the economic difficulties. In most cases the countries have their characteristic money units, and banking systems, national economic policies, and the relations are further confused by a variety of tariff arrangements. Considered as a whole, the European market is much less free than it was in 1913. This condition is even now proving a handicap upon the immediate development. In many cases, the twenty-five or more European countries are poorly supplied with raw materials and it is impossible to build up a well-coördinated economic organization. Many are inadequately supplied with both commercial and industrial capital, and in many regions the workers have not been trained in anything but hand-labor systems of production. Per capita production is small, compared with Germany and France, and very small compared with the United States.

The presence of numerous national borders, as a result of many different national economic policies, is a serious handicap in the development of a more orderly and effective economic system in Europe as a whole. Evidently two sets of values have come into clash, namely, the political and racial, on the one hand, and the economic on the other. In most cases the peoples of these countries have rated the former as of more importance than the latter.

Thus, the economic condition of Europe is in strong contrast with that of the United States. Here, a great area exists under one national jurisdiction, and an enormous free market supplies one of the greatest incentives to trade. The economic organization of this country is as thoroughly integrated as possible and the various parts of the country function together with the least possible resistance. Specialized industries may be founded in regions which offer the best economic advantages and the output may be supplied to other regions without interference of tariff boundaries, and without the intervention of foreign, and sometimes, as in the case of Europe, hostile trade legislation. Moreover, the uniform facilities for trade add greatly to our opportunities for expansion—conditions which are denied to Europe and its various countries.

ITALY

The classification given above has no reference to future prospects for development. Of the three countries given in the second group, Italy possesses the greatest opportunities for expansion. For one thing, the large population makes the country one of the greatest potential markets in Europe. With a population of about 40,000,000 in 1926, Italy ranks with France in numbers and is not far behind the United Kingdom. The population is increasing steadily; in fact, it is growing too rapidly for absorption in the domestic industries, and the country is confronted with the problem of finding occupation for its growing numbers. At present the problem is solved partly by emigration. From 1913 to 1926 inclusive, Italy sent out more emigrants than any country in Europe, except possibly Russia. The United States has received large numbers; but since the War the overseas migrations have moved more largely to South America. In Europe, France now receives the largest immigration from Italy. From 1913 to 1926 the total emigration from Italy was 3,823,000. This number was about equally divided between Europe and the Americas. The figure given above is not a total loss of numbers for the reason that during this period about 1,390,000 Italians returned home. These returned immigrants bring back new mechanical knowledge and skill and contribute materially to the industrial upbuilding of their home country. In many cases their foreign sojourn has been a period of education, of which the home country ultimately gets the benefit.

As with other nations on the continent, the development of Italy was retarded by wars and internal political troubles. This country was not able to put its home affairs in order until after 1870, and even at that time, due to the poverty and industrial backwardness of the people, Italy could not share in the industrial advance of some of the countries to the north and west. Unification paved the way for a national policy with respect to economic matters, and also made possible the entry of the country into the field of colonial expansion. In the course of time Italy built up a colonial empire of considerable proportions, although at great expense, and with no immediate prospects of an adequate return. This empire in Africa consists of Eritrea, bordering on the Red Sea; Italian Somaliland; and Tripoli and Cyrenaica, bordering on the Mediterranean.

During the last twenty-five years Italy has made remarkable progress in the development of industries. Agriculture is still the predominant interest, but factory production of silk, cotton, knit goods, rayon, iron and steel, and automobiles has made notable progress. During 1926 about 34,000 Italian cars were shipped abroad, particularly to Austria and Germany and to North Africa and South America. Italy is the largest European producer of artificial silk. From practically nothing in 1913 the output has grown to about 17,500 metric tons in 1926. Although natural silk is also one of the industrial products (50,000 tons of cocoons in 1926) the output no longer satisfies the demand of home industries and large quantities of raw silk are imported. Silk and its manufactures are the largest single export of the country. In addition to factory products, Italy produces a long

Isotta Fraschini Motor Co.

The Isotta Fraschini motor works at Milan, Italy

list of commodities—chiefly the result of hand work—which are noted for their workmanship, such as products from leather, glass, straw, jewelry, and ornamental ware of various descriptions.

Italy is poorly supplied with the industrial metals. Production of iron ore in 1926 was only 456,000 metric tons and of coal and lignite 1,377,000 metric tons. The country produces also lead, zinc, sulphur, marble, and some important building stones. Upwards of 60 per cent of the people are engaged in agriculture. Wheat is the most important cereal and corn ranks second in importance, but rye, oats, barley, and rice are cultivated, and potatoes and sugar beets are important crops. Italy is one of the largest world producers of grapes and olives, and this signifies that wines, olive oil, and the by-products of these industries are among the leading manufactures. In addition to the textiles the export trade includes oranges, lemons, eggs, almonds, wine, olive oil, marble and alabaster, soaps, essential oils, and perfumes.

BELGIUM AND HOLLAND

To all intents and purposes these countries form a part of the great industrial areas of northern France and western Germany, and in many respects the progress of industries in these two smaller countries is related to industrial activities in France and Germany, notably in the cases of coal, iron, and machinery. The magnitude of the industry of these countries is one of the remarkable features of industrial development in Europe. Belgium covers about 11,700 square miles and has a population of about 7,800,000; and the Netherlands covers 13,200 square miles with about 7,500,000; and yet their industry and commerce are on a larger scale than is the case with a number of other countries which are more populous. Both countries have accumulated large amounts of industrial capital, and both are important investors in foreign enterprises. The Netherlands still retains many of the colonies which she obtained during the years of discovery and exploration, and some of these possessions have become important producers of commodities which the world demands. In addition, they contribute materially to the commerce of the home country. The Dutch East Indies, for example, produce rubber, sago, coffee, tapioca, tobacco, tea, copra, and oilseeds of various kinds; and the Dutch West Indies are producers of coffee, rubber, cacao, and bananas. In the case of Belgium, the Belgian Congo in central Africa is rich in certain mineral products, to say nothing of products of the vegetable kingdom, such as palm-nut and palm oil and rubber.

Within the last few years the development of this region has proceeded with great rapidity. In 1925 and 1926 some 30 new companies were organized with a capital of 150,000,000 francs for the purpose of exploiting the resources of this area, and existing companies increased their capital by 250,000,000 francs. One of the chief attractions is the rich copper mining area of Katanga, but the precious metals are also receiving attention. Some idea of the extent of the contemplated improvements is shown by the fact that in 1926 a loan of 700,000,000 francs was issued in Belgium, the proceeds of which are to be used for improvements in the Congo, particularly in railroad building.

Agricultural production in the home countries is necessarily limited, due to the small area in which the people work, but by intensive cultivation farmers obtain a high yield per acre. In Belgium, for example, in the years from 1920 to 1926 the yield of wheat was from 35 to 37 bushels and of potatoes from 250 to 275 bushels per acre. In the Netherlands it was from 35 to 41 bushels in the case of wheat, and from 250 to 260 bushels in the case of potatoes. In the United States, the yield of wheat is rarely in excess of 16 bushels, and the average over the last ten years is about 14 bushels. In the last ten years, the average annual yield of potatoes was about 101 bushels. The field crops of the Netherlands and Belgium include wheat, rye, barley, oats, potatoes, sugar beets, and flax. Both countries grow a large amount of livestock in proportion to their size. The Netherlands exports butter, cheese, condensed milk, pork products, and eggs, among other agricultural products. And this country is a large exporter of flower bulbs, and garden products. The Netherlands is particularly deficient in mine and quarry resources, and this is largely true of Belgium, except for deposits of coal and the rich resources of zinc. The manufacture of cotton textiles, diamond cutting, the production of flour, margarine, cacao and chocolate, brick, tile, and furniture are the leading industries of the Netherlands. In the case of Belgium, iron and steel plate and window glass, and certain textiles such as linen, cotton, woolens, and rayon materials are among the principal manufactures.

CZECHOSLOVAKIA, SWITZERLAND, ETC.

The countries in the third group as outlined on the first page of this chapter present a varied assortment of conditions. Czechoslovakia has fallen heir to practically all the sugar-producing area of old Austria-Hungary, and to about half the alcohol distilleries, to nearly two-thirds of the iron-producing capacity, and to about four-fifths of the textile industries. The famous Bohemian glass industry and much of the china industry have come to the new country. Czechoslovakia is almost self-sustaining with respect to food products. It produces wheat, rye, barley, oats, corn, potatoes, hemp, and flax. It is the second largest producer of beet sugar in Europe. The mineral products include coal, iron, and graphite. The leading exports are sugar, wood and coal, glass and glassware, cotton and woolen goods, and products of iron and steel. The manufacture of glass is one of the oldest industries of the region. The first glassworks were founded in Bohemia early in the eleventh century and the industry has been pursued with scarcely an interruption to the present. In recent years, competition with France, Belgium, and Germany has deprived Czechoslovakia of some of the benefits of the expanding world markets but the industry has retained a measure of prosperity. Gablonz ware supplies the country with a characteristic line of products, which include art glass products, imitation jewelry, beads, and imitation pearls. Much of this work is the output of individual workers in the home. Czechoslovakia covers about 54,200 square miles and has a population of 14,100,000.

SWITZERLAND

The growth of industry in Switzerland during the last fifty years brought great changes in the character of the import trade and in the nature of activity of the people. Since "the maintenance of the population of Switzerland is now depending on manufacturing industries, importations of raw materials and exportations of manufactured products have become highly characteristic of Swiss trade."[1]

At present about 75 per cent of the products of the twelve leading Swiss industries are exported. In some cases the percentage is higher than this figure, as with watches, embroideries, silks, silk ribbons, and aniline dyes. Switzerland has practically no mineral resources except salt and a little iron. If the country engages in manufacture it is therefore necessary to import metallic materials and to export finished products in payment. Except for small amounts of wool and natural silk of local production the country is also dependent on the outside world for textile fibers.

Switzerland produces wheat, spelt, rye, barley, oats, and potatoes, but in all these cases home production is below consumption and importation is necessary. In the production of meat and dairy products the country is more than self-sustaining. In fact, natural conditions, including frequent rains and the nature of the soil, which is conducive to the growth of grass, are favorable to the support of milk herds. Various products of milk are the most important food exports of Switzerland. These include condensed milk exported to France, Germany, Austria, and Italy; cheese exported principally to the United States and Germany; and chocolates, the production of which requires milk. Swiss scenery ought to be set down as a resource because it accounts for a considerable income to the people in the form of revenue from transportation, hotel bills, and purchases of foreigners within the country. There is a natural compensation for the lack of fuel in the splendid water-power resources which are now being developed on a large scale not only for power purposes in factories and light and heat, but for the operation of railways.

The shortage of raw materials has forced upon the country the policy of producing commodities which are characterized by excellence in workmanship and distinction in quality and design. Swiss textile producers, for example, maintain a staff of experienced designers "whose business it is to keep informed as to the demands for new types and styles of materials and to anticipate the needs of the market by creating new designs and products." Education of workers in their chosen crafts and the enterprise of the technical engineers in maintaining production equipment fully abreast of the times have helped to give Swiss textile manufactures a market in all parts of the world with the result, also, that Swiss export trade in textiles "is dependent to only a small degree on political or economic developments in individual countries."[2]

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[1] Trade Information Bulletin No. 42, p. 2.

The policy of featuring excellence of product also characterizes the manufacture of watches. Watchmaking in Switzerland was originally a home industry, and although there has been some tendency to employ factory methods, the establishments are still small. The Swiss government "exercises a certain control over the watch industry. With the assistance of the Government a number of technical schools for the training of workmen have been established, which have played a large part in establishing the high standard of the Swiss product. The government also maintains well equipped laboratories at Neuchatel and at Geneva, where the finer watches and precision instruments are carefully tested and where their accuracy is officially certified."[3]

It may be gathered from what has been said above that the export trade is composed largely of a number of specialized commodities which are the product of peculiar taste or skill in workmanship. Some of the leading exports are watches and clocks, silk fabrics, embroideries and laces, machinery and motor cars, cotton fabrics, silk ribbons, instruments and apparatus, cheese, condensed milk, and chocolate.

DENMARK

In some important respects the problem of Denmark is like that of Switzerland, namely, the lack of essential raw materials.

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[2] *Ibid.*, p. 26.
[3] *Ibid.*, p. 29.

The lack of coal and iron is notable, and there are no important sources of water power to make up for the shortage of fuel. With reference to area and population, Denmark and Switzerland are in about the same relative position. Denmark covers about 16,500 square miles with a population of 3,400,000, and Switzerland covers 15,900 square miles with a population of 3,900,000. Denmark, however, has cast her fortunes with agriculture; manufactures are of little importance except the production of pork and its products, condensed milk, sugar, margarine, cement, bricks, and Danish porcelain manufactured from local clays and from kaolin imported from Norway. The fisheries are of some importance. The exploitation of the waters of the North Sea for herring, whiting, and cod provides an occupation for a number of people. Denmark engages to some extent in shipbuilding. In 1926 about 1,000,000 tons of shipping were owned in the country. The products of agriculture constitute the principal items of export, amounting to about 70 per cent of the total. The most important articles are pork, bacon, butter, and eggs. The development of the livestock industry has been discussed in a former chapter.[4]

SPAIN AND PORTUGAL

We have seen in the chapters on mineral resources that Spain is well provided with certain minerals such as iron, zinc, lead, and mercury and possesses considerable supplies of coal. Deposits of tin are scattered in some of the northern regions, but they cannot be extensively developed at present in competition with the product from Bolivia and the Malay states. Copper, also, which occurs in the southwest, labors under the competitive handicap. The iron ore is extracted mainly for export. Shipments are made from Bilbao and Santander to various European countries. The development of the minerals is carried on largely by foreign capital and the materials are developed for the benefit of foreign industries. As yet Spain consumes only a small portion of the products of her mines.

Spain is not well supplied with timber. The oak and beech are important trees along the slopes of the Pyrenees, and the cork oak thrives in the southwest. The cork oak is especially important in Portugal. Fishing is of importance in both countries, sardines, anchovies, and tunny being the leading varieties. With a few exceptions, manufactures in both countries are of little or no importance. Barcelona is known for its textiles, Valencia for its manufacture of silks, and Jerez for the production of sherry; and in Portugal, Oporto is known for its trade in port wine. The cereal crops of both countries include wheat, oats, and rye. Spain produces oranges, lemons, and figs, and the production of grapes and olives forms the basis of important industries.

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[4] See Chapter XVI.

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Cork coming to market in Spain

The industrial backwardness of Spain is remarkable in view of the enormous advantages the country possessed several centuries ago when her great colonial empire gave her unusual opportunities for trade, and when the new American gold was supplying a stimulus to industry in other countries. Unfortunately, Spain was afflicted with some of the industrial diseases which troubled her colonies, namely, apathy of the ruling classes with respect to industrial matters, antipathy towards industrial and commercial pursuits among those who might have been the industrial leaders, and the impoverishment of the country by wars. Widespread illiteracy, lack of industrial capital, and lack of means of transportation are among the present difficulties. There are at present only 9,800 miles of railways in the country, which cover about 195,000 square miles. The present population of Spain is about 22,000,000.

Swedish State Railways

A hydroelectric development in Sweden

NORWAY AND SWEDEN

Lumbering and fishing are important industries in both countries. More than half of Sweden is covered with forests. Pine and fir are the most important timbers, but oak and beech are of some importance in the southern part of the country. The methods of developing the lumber resources have been discussed in a former chapter. Although Norway possesses deposits of iron and copper, the resources are not abundant enough for extensive development at present. Sweden possesses more important supplies of iron, copper, lead, and zinc. Iron ore is developed to some extent for local use, but the larger part of the product is exported to other countries. Both countries possess important water-power resources, which are being gradually developed partly in connection with the electrical-chemical industries. Both countries engage in the manufacture of lumber and timber products, match making, and shipbuilding. Norway exports chiefly fish, lumber, wood pulp, and paper. In addition to lumber, wood pulp, and paper, Sweden exports iron ore, iron and steel, and machinery.

Norwegian Government Railways

Drying fish in one of Norway's many small harbors

AUSTRIA

This country has been one of the greatest sufferers in Europe from the aftermath of wars. As an outcome of the late War the territory has been reduced to 32,200 square miles with a population of about 6,700,000.

As a result of the postwar readjustments of territory, the country has lost some of its valuable resources and industries, and is deprived of its former advantages of integration under a single jurisdiction. Some minerals, such as iron, lignite, anthracite, copper, zinc, and lead, remain within the present territory. A little more than one-third of the country is covered with forests. The manufactures include cottons, woolens, glass, paper, and iron and steel. The foreign trade is chiefly with the near-by countries.

HUNGARY

Agriculture is the principal occupation of the people of this country. The farmers produce the ordinary cereals, and there is usually a considerable surplus for export. This is particularly the case with wheat which is one of the chief exports. Foreign shipments include also animal products, eggs, poultry, flour, sugar, and wool. With the exception of the production of electrical equipment the manufactures are only of local importance. The country has no mineral resources except lignite and small deposits of iron ore. Hungary covers about 35,800 square miles with a population of 8,400,000.

POLAND

It can hardly be claimed that Poland suffered from German or Russian domination. The areas which are now brought together in the new Poland have shared in the economic progress of the past thirty years. Reëstablished as the result of the War, the country contains about 12,000 miles of railway and many of its resources have already been highly developed. Galicia, recovered from Austria, contains valuable salt and petroleum resources; the rich coal fields of Upper Silesia were awarded to Poland in 1922. With an area of nearly 150,000 square miles, Poland is now one of the largest countries in Europe. The population in 1921 was 27,100,000. In addition to the valuable deposits of coal and petroleum the new country contains the third largest potash resources in Europe, and one of the richest zinc-producing areas in the world. About 24 per cent of the total area is under forests. The new country is therefore fairly well supplied with industrial materials. Agriculture is now the leading branch of industry. Possibly two-thirds of the population are engaged in farming. Rye and oats are the leading cereal crops; wheat and corn are of minor importance. Potatoes, sugar beets, linseed, and flax are important products.

BULGARIA, ROUMANIA, LATVIA, ETC.

Most of the other smaller countries in Europe are engaged mainly in agriculture. In some cases they possess local supplies of certain minerals. Manufacturing is largely a home or shop enterprise. Most of these countries contain great possibilities for development when the proper economic conditions are supplied.

Bulgaria exports attar of roses, skins, hides and furs, and copper matte. Roumania is the second largest producer of petroleum in Europe. The manufactured products of petroleum are among the chief exports. Roumania also sends abroad wheat, oats, barley, corn, and flour. The exports of Latvia and Esthonia are mainly agricultural products. Practically the whole export trade of Finland is in wood, rough timber, wood pulp, and paper. Finland ranks second to Russia in timbered area. About 90 per cent of the country is under forests comprising about 76,000,000 acres. Farming is the leading occupation in Greece. The cereals are grown only for domestic consumption. Leaf tobacco is the main export, and the next in rank are currants, olive oil, wine, raisins, olives, and figs. Small quantities of emery, magnesite, iron, and lead ore are produced for export.

RUSSIA

If abundance and variety of resources, or even potential markets, were the immediate conditions for economic advance, Russia would be one of the leading industrial countries of Europe.

But hitherto, political and social conditions have largely determined the character of economic development. During the hundred years or more that modern economic and political ideas were making rapid progress in western Europe the rulers of Russia adopted the conscious policy of excluding the new thought from their empire. They feared that freedom would undermine the nation, and they believed that the safety of the country depended on keeping the people ignorant. Alexander I (1801-1825) began his reign in a hopeful manner by encouraging the development of more liberal ideas. He revoked the decrees of the previous ruler which had prohibited Russians from traveling abroad and which excluded foreign publications. Under the new régime several new universities were established and government aid was granted to scholars. But this proved to be only a brief intermission in the reign of autocracy. Later, Alexander caught something of the spirit of the Congress of Vienna; he became apprehensive of revolutions; he got rid of his liberal advisers and returned to the policy of his predecessors. Among other things, the teaching of modern science in the universities was prohibited and students were forbidden to attend German universities.

Internal affairs offered no more stimulus to development than foreign relations. Roads were intolerable and the streams offered the only means of carrying the small surplus of certain regions to market. Until the liberation of the serfs in 1861 millions of peasants were bound to the soil. Although the decree of 1861 alleviated conditions to some extent it left the serf a kind of ward of the government. He was still bound to the land and could not depart except by permission of the government. "The landlords surrendered a portion of their estates to the peasants, but this did not become the property of individual owners, but was vested in the village community as a whole. The land assigned to each village was to be periodically redistributed among the various families of the community so that, aside from his hut and garden, no peasant could lay claim permanently to any particular plot of land as his own." [5] Meanwhile, the rebellious attitude which existed among many of the Russian people was not conducive to an orderly development of industrial affairs.

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[5] Robinson and Beard, *The Development of Modern Europe,* Vol. II, p. 273.

Russian industrial policy began to take on a more modern aspect about 1891 with the appointment of Witte as minister of finance and commerce. He saw that national strength lay in a well-rounded development of economic activities. He encouraged the founding of new enterprises and offered facilities for the investment of foreign capital. The latter condition was necessary, for the country itself could not supply the means for rapid industrial expansion. Mining enterprises were developed, and in the course of time, capital was invested in textile, mechanical iron and steel, and other industries.

Russia was one of the last of the great powers to take a serious interest in railroad building. In 1897 the Empire possessed only 13,000 miles; but subsequently railway expansion was pushed more energetically; at that, the mileage of Russia today, in a territory which covers 8,189,000 square miles, is only 46,300 miles. One of the most extensive enterprises was the building of the trans-Siberian railroad, begun in 1891 and completed for travel in 1900. Russia could not accumulate the capital for investment in railroads and it was necessary to borrow in foreign markets. The late War and the present experiments with economic reform have checked the progress of former years, but the country has enormous possibilities for economic development when the proper economic conditions are supplied.

The empire-building processes of Russia have been somewhat obscured by the fact that most of the new territory acquired was adjacent to the old. To a large extent, control has merely expanded into continuous areas. Russia controlled very little outside the great land mass known as European and Asiatic Russia. No one can guess what the outcome of the present political and economic experiments will be, but we can say that if the 8,000,000 square miles which now constitute Russia are consolidated into one economic organization it will constitute in time the most powerful industrial empire in the world. The dominions of Britain and France are scattered over the world, and therein lies a weakness, but those of Russia exist in one continuous stretch of territory which in time may be brought together into a great economic organization.

The physical resources of this territory are not only widely diversified but in many cases particular resources exist in great abundance. The mineral deposits of Asiatic Russia, and for that matter, of the European part as well, have not been adequately surveyed, but present information indicates that this area contains all the leading industrial minerals in great abundance. In addition, there are many thousand square miles of unoccupied farming lands which are not unlike those of the central portion of the United States, and the requirements for development are the same, namely, transportation facilities, immigrants, capital, and enterprise.

Russia contains a great variety of mineral resources. Hitherto the coal resources in the basin of the Donetz have received the greatest attention. This field covers "an area of 16,000 square miles, the seams varying from 1 to 7 feet in thickness. There are about 200 seams of coal in the field, with a total depth of 14,000 feet. Of these from 25 to 40 are workable."[6] Large quantities of coal exist also in the Ural Mountains, in the Caucasus, and in the province of Moscow. The deposits in the Urals have been only slightly developed. They are at a great distance from the largest consuming centers, and at present, lack of transportation renders these sources inaccessible except for industries in the near neighborhood. The coal of the Caucasus areas is poor in quality but it exists in large quantities. Siberian resources are believed to be extensive, but there has been little or no need for exploitation, nor even for surveys.

Although iron ore does not exist in great masses as in a few places in western Europe and the United States, Russia contains many scattered deposits. In the aggregate these resources amount to an important supply. The resources which have been most extensively developed are in south Russia, where the metallic content is high. The best ores "average 70 per cent pure, and the chief sources of supply are the Krivoi-Rog mines, about 100 miles inland from Nicolaief."[7] Estimates of the extent of the deposits range from 85,000,000 to 200,000,000 tons. Under the old régime the iron trade of Russia was in the hands of the "Prodamet" trust, composed of some thirty leading iron enterprises of Russia.

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[6] *Russia,* Special Consular Report No. 61, p. 131.
[7] *Ibid.*

Copper exists in the Urals, in the Caucasus, in western Siberia, Turkestan, and other places. Extensive deposits of manganese are found in the Caucasus. Platinum, gold, and silver occur in the Urals. Hitherto, Russia has been the chief source of supply.

Since 1860 Russia has ranked second as a world producer of petroleum. The Baku fields in western Transcaucasia are still the chief Russian source, but this area has begun to show signs of exhaustion. Other districts give promise of a large output, as with the Grozny area north of the Caucasus, and the Maikop field on the western edge of the Caucasus range. The forests constitute another important resource. Russia contains one of the largest sources of timber in the world, covering possibly 600,000,000 hectares in the Ukraine, Transcaucasia, White Russia, and Asiatic Russia. The stand includes pine, spruce, larch, oak, ash, and beech. Under the present régime the State is the sole owner of forest lands.

In the absence of adequate railway service Russia has the compensating advantage of an extensive waterways system, which, including rivers, lakes, and canals, affords about 180,000 miles of navigation. Upwards of one-third of the freight of the country moves over the waterways. The Volga system is the most important, covering about 19,000 miles of navigable streams. Since the Volga flows into the Caspian Sea it has been necessary to find another outlet for much of the traffic of this stream and this is accomplished by transferring river freight to railroads at Tsaritsin and thence to the Don River, which empties into the Sea of Azof, an arm of the Black Sea. Canals connect the Neva and the Volga, the Vistula and the Dnieper, and the Dvina with the Dnieper.

The agricultural resources are the greatest asset of the country. Russia produces large quantities of wheat (809,000,000 bushels in 1926), rye (897,000,000 bushels), barley (260,000,000 bushels), and oats (903,000,000 bushels). The fields also yield linseed, flax, fiber, hemp, potatoes (1,800,000,000 bushels in

1926), sugar beets, tobacco, and cotton. In 1926 the farms of the country contained 60,000,000 cattle, and 102,000,000 sheep, to say nothing of large numbers of horses, swine, and goats.

Coöperative organizations existed long before the late War, and whatever may have been the original intention of the revolutionary government, these societies are now recognized as an essential part of the Russian economic system. The coöperatives are divided into two great classes, namely, the consumers' organizations, which serve mainly the urban population, and the agricultural societies, which are highly developed in some of the agricultural regions. They handle the marketing of such products as butter, potatoes, fruits, and flax. The All Union Coöperative Bank serves the general banking needs of the coöperative societies.

Soviet plans for ownership and operation of industries have changed from time to time. At the time of the Bolshevik revolution the Soviet authorities took over all property belonging to private owners. The status at present is indicated in the following statement:

> Although the state continues as the owner of all major factories and exercises wide-reaching control, the system is gradually gaining ground by which the factories are put on a profit-and-loss basis. They are expected to produce, in accordance with instructions, constantly increasing quantities and to sell at fixed prices, but none the less make a profit. As a matter of fact, the profits earned by the so-called manufacturing trusts are inconsiderable; their debts to the state, to the banks, and even to their own workers for wages in arrears are constantly increasing. In striving for maximum production quality of product often suffers. With the increasingly independent attitude of labor the mills have to contend with inefficiency and lack of discipline of employees and unreasonable demands. Urged by the state to economize, to lower overhead charges, and to reduce prices, mill managers are hampered by restrictions of many kinds and, as a matter of fact, find themselves unable to control market prices, which tend constantly to rise. What the Russians speak of as the scissors—discrepancy between the peasants' selling and buying prices—is again causing great concern, the gap growing larger in spite of the government's efforts.[8]

Among other features of the present system we should mention the grant of concessions to foreign capitalists. The government exercises close supervision over the concessionaires—to such an extent that many of these grants have proved unprofitable. The lack of capital within the country to develop resources and industries makes foreign exploitation necessary. The Germans have been among the largest recipients of grants, but some English and American capital has entered Russia under the concession plan. An American company, for example, is developing the manganese resources in the Caucasus.

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[8] *Commerce Year Book,* 1926, Vol. II, p. 463.

The government controls foreign trade mainly through monopolistic corporations which have the exclusive right to trade in certain commodities. It is needless to say that the present authorities have departed from the plans of the group which held power in 1920. In many respects the system seems to be coming back to a modified private ownership under strict regulation by the State with respect to wages, prices, and working conditions.

QUESTIONS

1. What effects can you assign to political boundaries in the development of industry in Europe?
2. Is the absence of a free market throughout Europe a serious handicap to the economic development of this area?
3. Contrast Europe and the United States in this respect.
4. Discuss the population problem of Italy.
5. What features characterize the economic growth of this country?
6. In what respects is Italy handicapped by lack of raw materials?
7. Is any considerable amount of Italian capital invested abroad? Contrast with England, France, and Germany, and account for the differences.
8. Account for the industrial growth of Belgium and Holland.
9. Discuss the leading features of Swiss industry.
10. Explain how the shortage of raw materials has affected the industrial policy in Switzerland.
11. Account for the features of industry in Denmark.
12. Why have Spain and Portugal been industrially backward?
13. Why has not industrial growth in Russia kept pace with that in western Europe?
14. Estimate the effect of political institutions on industrial progress in a country.
15. Estimate the industrial future of Russia.
16. Do you think that foreign capital must play an important part in the development of Russia? Why?

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CHAPTER XXXI

RESOURCES AND INDUSTRIES OF ASIA

It is remarkable that Asia which contains some of the oldest inhabited regions in the world should lag so far behind America and western Europe in industrial development. Possibly antiquity is itself a factor in this backwardness, for over much of the continent people have been bound by custom and tradition to such an extent that progress has been impossible. The retarding influence of religious, and even of philosophical, doctrines, played a part for centuries in preventing the introduction of new ideas, and in encouraging people to be contented with what they had. Although Portuguese trading vessels began to visit Japan in 1542 and continued to trade until about 1639, the empire was practically closed to outsiders until the negotiation of treaties by Commodore Perry in 1854 and by Admiral Sterling in behalf of Great Britain in the same year.

THE GENERAL CHARACTER OF INDUSTRY

Here and there where a region has been touched by western ideas the old forms of industry are passing away and industrial life is beginning to be modeled on the mechanical systems and divisions of labor of the West. But the regions in which this development has taken place are small in proportion to the total area of Asia. The factory system has made notable progress in Japan in the last thirty-five years; more recently, factory methods have been introduced into a few places in China, and the same system is making rapid progress in a few places in India, as in Bombay and Calcutta. Modern commercial methods are beginning to revolutionize trade in an even larger area; and western political and social ideas are changing life and thought in many of the older regions. But it is a long step from the new idea to the type of industry and social life which it ultimately produces.

Men can be trained to modern economic methods only after years of experience, and time is required to develop railways, to open resources, and to raise people to a standard of living where their purchasing power creates considerable home markets.

One indication of the backwardness of Asia is the lack of railway transportation; in 1926 the total mileage was only 68,300. More than half of this was in India. Japan contains about 10,400 miles of railway, China about 4,700 miles, Turkey 2,100 miles, Persia less than 200 miles. Some of the rivers have been important means of transportation, as the Hwang Ho and the Yangtse-Kiang of China, and the Ganges and Brahmaputra of India. The Ob, Yenisei, and Lena, rivers of Siberia, although of great length, have little present commercial importance. The Irrawaddy of Burma carries an active trade and this is true of the Mekong which flows through Siam and Cambodia. In western Asia, the Tigris and Euphrates have only limited commercial possibilities. Vast portions of Asia are served only by roads, and in many cases only by trails. Transportation is not a cure for industrial backwardness; it is only one of the agencies which make for progress; but as long as people are not served with adequate means of shipment, there is little or no territorial specialization of industry, and communities make their living in about the same way and produce about the same commodities. Why are railroads not built more rapidly in the densely populated areas of China, where one would expect that a great volume of traffic would make the enterprise yield immediate profits? The reader might try to give the answer—which, incidentally, contains the explanation for much of the industrial backwardness of this country.

In a former chapter we have discussed the resources and industries of India. In this chapter we shall discuss industrial conditions in Turkey, Persia, China, and Japan.

TURKEY

There is no doubt that the failings of the human resource largely account for the retarded development of Turkey. The economic characteristics have been described as follows:

> The Turk, who thus defies analysis as a race, is equally interesting as an individual. He is sober, physically clean, and self-respecting; he is fatalistic and improvident. As a business man he is trustworthy but inexperienced. He has never in the past resorted to trading for his livelihood, but has confined his expenditure of effort to administrative and military activities and to agricultural pursuits. However, the wholesale abolition of government offices by the present Republican régime, the prevailing economic distress in Turkey as a whole, and the forced or voluntary departure of the Greek, Armenian, and Jewish producers and traders are driving increasing number of Turks into the business world.[1]

Pure races would be difficult to find anywhere in the world, but the Turk seems to have had more than his share of the blending. He has intermarried with all his neighbors irrespective of origin or religion and thus the complex includes a varied assortment of peoples.

Turkey covers about 283,000 square miles, including about 9,000 square miles in Europe. The population is estimated at about 13,000,000. The activities of the people are mainly agricultural and pastoral. But the system of agriculture belongs to some of the ages of the past. Modern farm machinery is being introduced gradually but

> a great part of the plowing is still done with an ox-drawn metal-tipped stick. Artificial fertilizers are not used at all, and even natural manure is not properly used. A crude sickle still serves extensively for harvesting, and the grain is generally separated on the threshing floor of beaten earth by means of the ancient drag incrusted with flint. Passable roads and highways, railways, and irrigation are in their infancy. Agricultural instruction is beginning, however, and taxation is less grinding since the removal of the tithe.[2]

The land system has had much to do with the backward state of agriculture. Farms are usually small, ranging from 2 to 25 acres. In many cases the peasant has lost his independent status and has become a laborer, cultivating the land on shares with the owner. The "squire's" portion is to supply the seed, and the peasant does the work of planting, cultivating, and harvesting. The landlord is repaid his loan, taxes are deducted, and the remainder is divided between landlord and tenant. Hitherto the burdens of taxation have nearly ruined the peasant. He paid the tithe, and land, road, and school taxes, and in addition he was subject to military requisitions. There was no wonder that he kept as close as possible to his personal requirements, for any excess was taken away either by the landlord or by the tax gatherer. The system of collection rendered the tax system all the more vicious. Taxes were farmed out; that is, the right to collect was sold to individuals who exacted from the cultivator all the traffic would bear. Fortunately, under the new régime, the peasant is to receive some relief from this burden. But the problem still remains of putting the land in the hands of the actual cultivator and of providing him with the credit to carry on his work.

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[1] G. B. Ravndal, *Turkey,* Trade Promotion Series, No. 28, p. 20.

[2] *Ibid.,* p. 86.

Wheat is the most important cereal crop—152,000,000 bushels in 1913. The country also produces barley, oats, millet, rye, corn, and canary seed. Turkey produces most of the common vegetables including broad beans, chick-peas, lentils, kidney beans, vetch, onions, and garlic. Tobacco is one of the most important commercial crops. It was introduced indirectly from America and became a factor of economic importance about 1685. Farmers pay particular attention to the quality which is demanded by American manufacturers of cigarettes. About 70 per cent of the output of the Samsun and Smyrna districts is exported to the United States and the remainder is sent to Egypt and to various European countries. Turkish tobacco differs in important respects from the American product. Turkish leaf is much smaller than the American, the average size being from 3 to 4 inches in width and length. Moreover, the leaf is thin, a thousand or more being required to average a pound weight. But the most "marked difference is in taste—the pungent, spicy aroma being distinctly different from the American type."

Turkey has produced cotton for many years. The staple is short and rough but it meets the milling requirements of a number of European countries. The product is exported to Italy, France, Spain, Germany, and in recent years small quantities have been consumed in the United Kingdom. The Turkish government has employed American experts to show how American seed can be grown more successfully. Turkey produces an amazing variety of products, which is an indication of what might be expected when the country is supplied with the proper economic conditions. Some of the other products are opium; poppy seeds, from which oil is extracted; olives; linseed; flax; licorice root; caraway seeds; mustard; gum tragacanth; attar of roses; and certain vegetable dye and tanning materials including madder, sumac, valonia, saffron, and gallnuts. Figs, raisins, walnuts, filberts, almonds, pistachios, and pignolias (the edible seeds of the pine cone) are among the exports.

The forest resources are considerable. The most important trees are the pine, oak, hornbeam, fir, cedar, and beech, but the forests contain smaller numbers of poplar, juniper, chestnut, ash, valonia oak, linden, and cypress. Among all the resources of Turkey the forests have aroused "the least interest and suffered the most neglect."[3]

There is no doubt that Turkey contains a variety of mineral resources, but there is little or no accurate information concerning the extent and composition of the deposits. Some resources were worked in early historical times and have been long since abandoned. The ''ancient pits and half-buried mounds of scoria'' bear testimony to the fact that the copper deposits were worked centuries ago possibly by the "mysterious but presumably highly civilized Hittites who once made Asia Minor their home." The Phœnicians are believed to have mined copper at Argana, a small town 40 miles north of Diarbekr, 4,000 years before the Christian era. "Anatolian gold enriched also Priam of Troy. This is the country of the mythical Golden Fleece, and the habitat of the ancient Chalybes who are held by tradition to have first developed metallurgy. Silver working is a time-honored industry throughout the country, and copper, iron and manganese have played their part in the manufacture of weapons down through all the belligerent history of the descendants of Osman."[4] Crœsus is said to have acquired his riches by bartering Ionian gold for Athenian silver in the market of Ephesus, and by selling the metal again in Greece at great profit.

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[3] *Ibid.*, p. 116.

[4] *Ibid.*, p. 127.

Although the extent of the deposits are as yet unrevealed, Turkey contains coal, lignite, lead, copper, manganese, and iron. One of the world's greatest sources of natural emery is in a small area in the vilayets of Aidin and Mentesheh in western Anatolia. These deposits were discovered about 80 years ago by the American mineralogist, John Lawrence Smith. The development of substitutes, such as carborundum and corundum have thus far had little effect on the demand for the natural product.

Until the discovery of chrome in New Caledonia and Canada, Turkey produced more than half the world supply. The ore contains from 40 to 55 per cent chrome oxide and is used mainly in the production of chrome steel. Deposits in the Brusa region are estimated to contain about 10,000,000 tons, and are among the world's greatest known resources. Other chrome deposits are found in the Makri and Adana regions. The manganese resources of Turkey have received little attention, due to the lack of transportation and to competition from Russia, Brazil, and India. Turkey contains deposits of zinc, mercury, antimony, arsenic, and gold and silver, but as with other metallic resources, the quantities are unknown. The development of petroleum may become in time an important enterprise. This commodity probably exists in eastern Anatolia in connection with the oil fields of Russian Caucasus and of Persia.

Meerschaum, a fine white clay—called by this name because it was supposed to be the petrified scum of the ocean—is one of the unique products of Turkey. One of the largest sources in the world lies not far from the Anatolian railroad. Some of the sources have been worked for more than 2,000 years. Methods of exploitation are still primitive. The principal tools are a pick, basket, and windlass to hoist the material to the surface. Native traders polish the substance, rub it with paraffin, and grade and pack it for the market.

Manufactures in Turkey are mainly of the home and shop variety. They include cottons and woolens, rugs, carpets, shawls, silk and linen fabrics, and to some extent embroideries and laces. Home industry produces also a vast variety of bazaar and specialty articles such as lamp shades, decorations, embroideries, kimonos, Brusa towelings, meerschaum beads, mosaic necklaces, ivory and alabaster goods, to mention only a few of the products. The Turkish rug industry is of minor importance compared with that of Persia and other central Asiatic regions. Turkey has reaped much of the reputation, and not a little of the profit, from the sale of Oriental rugs because of the accessibility of Constantinople as a collecting and selling point, and because of the enterprise of European and American buyers. Through this city passed much of the trade in Persian, Caucasian, and Turkoman rugs and carpets, to say nothing of the products of Afghanistan and Baluchistan, which arrived by way of the Persian Gulf.

The new government of Turkey has set its face towards industrial development, encouraged if necessary by governmental aid. The government recently passed the "stimulation of industry" law which provides, among other things, relief from some of the burdensome taxes. Raw materials which cannot be produced in the country are also exempted from import duty. On the other hand, heavy import charges are placed on certain manufactures. The outlook for the success of the new program has been affected partly by the exodus of the non-Moslem element in Turkey. This loss is indicated by the fact that in 1915 the Greeks, Armenians, and Jews furnished upwards of 75 per cent of the capital and 85 per cent of the labor employed in Turkish industries. The Turk has been backward in the development of trading and manufacturing enterprises and it is not probable that new instincts can be imparted by legislation. This loss of industrial population is therefore a serious matter. Moslem elements which have returned from Greece, under the arrangement for exchanges of population, are mostly farmers. While they bring in additional labor and skill in the cultivation of tobacco, they add nothing to the industrial ambitions of the new government. On the other hand, the Greeks who have been expelled from Turkey have carried home new industrial knowledge and have added to the industrial population, and have contributed to the manufacture of certain textiles. From the point of view of manufacturing prospects Turkey lost by the exchange.

PERSIA

Persia is one of the countries which has been left behind in the rush of modern industrial progress. Centuries ago this country was the home of a busy industrial and trading people, but nothing remains to suggest the enterprise or the prosperity of the past. The country is somewhat smaller than that portion of the United States east of the Mississippi River, namely, 628,000 square miles, and contains a population of about 10,000,000. About 90 per cent of the people can neither read nor write. At present the total number of students in the country is only 96,000. Agriculture is the main occupation. The chief products are wheat, barley, rice, tobacco, opium, gums, cotton, and silk. Exports include rice, almonds, dates, raisins, tea, silk, cotton, wool, gum tragacanth, carpets, and rugs. The development of the petroleum resources has raised petroleum and its products to the principal export of the country. Prior to the War, Russia's capital was used to stimulate the production of cotton; English capital has been largely employed in the development of petroleum; and credits from various foreign countries have largely financed the trade in rugs. The production of petroleum is in the hands of the Anglo-Persian Oil Company which extracted about 4,500,000 tons of the crude product in 1925-1926.

So far as the outer world is concerned, rugs are the only important manufactures. Hand processes prevail in the preparation of the material and in the manufacture of the products. The rug industry was based originally on certain needs of the people. Domestic uses made the rug a necessity rather than a luxury, as in the outer world. These commodities served as prayer mats, divan covers, hearth rugs, sleeping blankets, and saddle mats. With the appearance of a foreign demand the production of rugs became a commercial enterprise. Years of experience have given the workers great skill in manufacture. Processes and designs differ from region to region. The methods of dyeing have also been learned by years of experience, and not a little experimenting has been required to learn what dyestuffs are best suited for the work. Only vegetable materials are used, such as indigo, saffron, orchil, coccus, and madder. The wool is carefully selected not only with reference to the locality where it is produced, but also with regard to certain parts of the fleece which are supposed to yield the best results. Rug making is a kind of cottage industry and the process of production is very slow. The income of the workers is remarkably small compared with the prices which are paid for rugs in the foreign markets. The household worker would have just cause for complaint if he knew the ultimate selling price of his product. Thus the $10,000,000 which was the value of carpets and rugs exported from Persia in 1925 had little or no reference to the total amount which these commodities commanded when they reached American and European consumers.

SIBERIA

Siberia has been characterized as "the largest world area awaiting development." [5] And it has been added that

> Western Siberia is one of the greatest areas of level fertile farm land awaiting development in all the temperate cereal-producing regions; eastern and southern Siberia is a great forest region, immensely rich in minerals, and already famed for its fisheries and furs. The climate of these regions is not dissimilar to that of Minnesota and the Dakotas. With hardly lower temperatures, it is drier; and with many more hours of sunshine per annum, the effect of the more northern latitude is consequently modified.[6]

Siberia contains about 5,000,000 square miles and has a population estimated at 12,000,000. The completion of the trans-Siberian railroad exercised a marked influence on the settlement of the country. During the 33 years prior to 1892, when the building of the railroad began to get under way, the colonists in Siberia did not exceed 600,000; in the ten years that the road was under construction another half million people were added to this territory, and since 1900 from six to ten million people have been added to the regions along the railroads. The effect on farming has been particularly marked. In 1894, for example,

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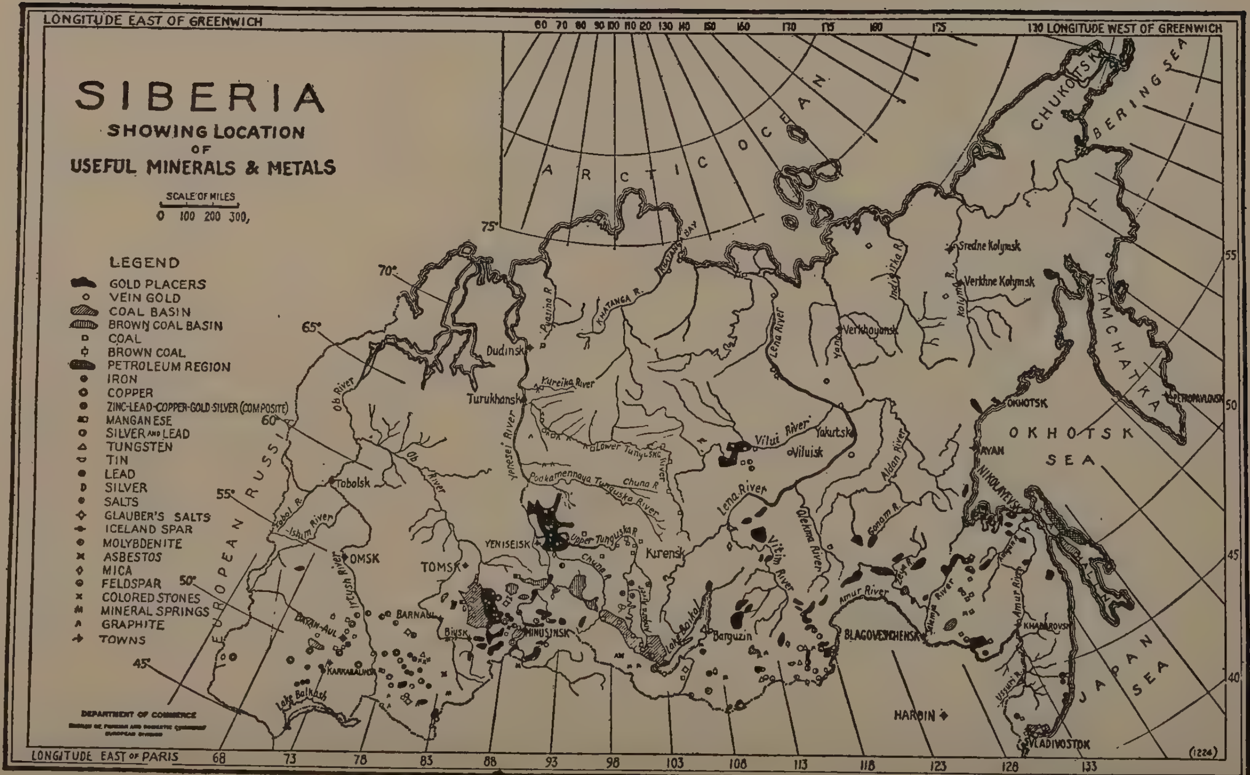
[5] B. Baievsky, *Siberia, Its Resources and Possibilities,* Trade Promotion Series, No. 28, p. 2.

[6] *Ibid.,* p. 52.


SIBERIA
SHOWING LOCATION OF USEFUL MINERALS & METALS
SCALE OF MILES
0 100 200 300
LEGEND
GOLD PLACERS
VEIN GOLD
COAL BASIN
BROWN COAL BASIN
COAL
BROWN COAL
PETROLEUM REGION
IRON
COPPER
ZINC-LEAD-COPPER-GOLD-SILVER (COMPOSITE)
MANGANESE
SILVER AND LEAD
TUNGSTEN
TIN
LEAD
SILVER
SALTS
GLAUBER'S SALTS
ICELAND SPAR
MOLYBDENITE
ASBESTOS
MICA
FELDSPAR
COLORED STONES
MINERAL SPRINGS
GRAPHITE
TOWNS
DEPARTMENT OF COMMERCE
LONGITUDE EAST OF GREENWICH
60 70 80 90 100 110 120 130 140 150 160 170 175 180 175
130 LONGITUDE WEST OF GREENWICH
LONGITUDE EAST OF PARIS
68 73 78 83 88 93 98 103 108 113 118 123 128 133
75° 70° 65° 60° 55° 50° 45°
55 50 45 40
(1224)
ARCTIC OCEAN
BERING SEA
CHUKOTSK
KAMCHATKA
OKHOTSK SEA
JAPAN SEA
EUROPEAN RUSSIA
Sredne Kolymsk
Verkhne Kolymsk
Kolyma R.
Indigirka R.
Verkhoyansk
Yana
Lena River
Khatanga R.
Khatanga Bay
Pyasina R.
Dudinsk
Kureika River
Turukhansk
Yenesei River
Lower Tunguska River
Podkamennaya Tunguska River
Chuna R.
Upper Tunguska R.
Vilui River
Yakutsk
Viluisk
Aldan River
Okhotsk
Petropavlovsk
Ayan
Nikolayevsk
Sakhalin
Zeya R.
Amur River
Olekma River
Vitim River
Lena River
Kurensk
Barguzin
Lake Baikal
Angara River
Blagoveshchensk
Khabarovsk
Ussuri R.
Vladivostok
Harbin
Yeniseisk
Tomsk
Minusinsk
Biysk
Barnaul
Omsk
Irtysh River
Tobolsk
Tobol R.
Ishim River
Ob River
Baian-Aul
Karkaralinsk
Lake Balkash

shipments of butter were only 7 long tons and 1913 they were 81,000 tons.

The effect of this railroad on the development of mining and lumbering has been less marked than on agriculture, largely because there is very little foreign demand for the products of Siberian mines and forests, and because of the heavy expense of transporting the products. The trans-Siberian railroad is mainly a trunk line extending from European Russia to the Pacific, and although some feeder lines have been built, the greater part of Siberia has no contact with the railroad, except by means of a long and expensive land haul. Thus, "this inadequacy of Siberian railroads is reflected in the fact that many important towns, even in rich regions in western Siberia—as the Altai region, the Steppes, and the Minusinsk region—are hundreds of miles distant from the railroad."[7] The extension of new lines is confronted with about the same difficulties which troubled railroad builders in the western part of the United States, namely, the absence of paying traffic, and it will thus be necessary to operate new lines at a loss. Much of the future railroad building must be in advance of settlement, as was the case with the United States.

Wagon roads of some description exist in many parts of the country. The total length is estimated at 90,000 miles, of which about 2,400 are improved. In addition, the country contains about 4,000 miles of pack trails. The mud of spring and fall, frozen ruts in winter, and numerous lakes and streams offer considerable obstructions to land transportation, but notwithstanding these handicaps many of the roads are described as "passable."

In a previous paragraph of this chapter we referred to the interior waterways of Asia. At present, the rivers of Siberia are in the natural state—obstructed by shallows, bars, and rapids, and often jammed with floating timber. There is a serious disadvantage in the fact that the three great streams of the north flow into the Arctic, and navigation at the mouth is open only three months of the year; but transportation on the lower courses can take place for a longer period—on the Ob, for example, from 165 to 200 days, and on the Yenisei from 153 to 203 days. But "the potential importance of these rivers for transportation is very great, if one considers the large number of tributaries of the several systems, closely approaching each other, which are well distributed over Siberia and which form a net of waterways that readily lends itself to interconnection and improvement."[8] The total length of the Siberian rivers is estimated at 81,000 miles. About 40 per cent of this mileage is fit for rafting, and about 30 per cent for navigation.

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[7] *Ibid.*, p. 53.

As with other parts of the world, the mineral resources of Siberia are known only in a superficial way. Coal deposits are said to amount to 400,000,000,000 metric tons. If this figure is anywhere near the truth, Siberia contains about one-fourth the coal of Asia, and about one-half as much as Europe, and less than one-tenth the amount of North America. The resource is fairly well distributed for future industrial purposes. The most important deposits are in Sakhalin Island, Kirghiz Steppes, the Minusinsk basin, the Irkutsk basin, and the Kuznetzk basin. The Sakhalin deposits are considered superior to all others on the Pacific.

There has been little or no prospecting for petroleum and the extent of this resource is unknown. Only small quantities are known to exist in western Siberia, but the resources of Sakhalin are considerable, estimated at from two to three billion barrels. A similar statement with regard to surveys applies to iron. In the present state of industry, and in the absence of adequate means of transportation, there has been no need for surveys. As far as the resources are known, Siberia contains only small quantities of iron ore, although certain known deposits contain a considerable proportion of high-grade ore. At least this much is known about Siberian minerals, namely, that they exist in great variety. All the common metals are present, and in addition gold, silver, platinum, iridium, and osmium, but it will be many years before the actual extent of the mineral reserves is known.

The forest resources are among the most important assets of the country. The stand includes pine, larch, Siberian fir, spruce, cedar, birch, aspen, ash, maple, and elm. Siberian forests "do not represent unbroken tracts. Instead, they are intersected by innumerable streams whose valleys consist of marshes or meadows, with here and there a forest stand. The forests generally follow not the river valleys but the watersheds, because the soil is not so wet; but even their vast marshes or large expanses denuded by fires intervene, especially in the northern part of western Siberia. The best stands are found on southern slopes protected from the Arctic winds."[9] Various experts who have tried their hand at estimating the extent of this vast resource have placed the forest area at from 800,000,000 acres to more than 2,700,000,000 acres. Whatever the extent, we can make this statement with certainty, namely, that a large part of this area cannot be tapped for many years. The most available areas are in western Siberia, where timber can be sent to market over the Ob and Yenisei, and in the Far East where the Amur serves as the chief prospective channel of trade.

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[8] *Ibid.*, p. 56.

Siberia is still an important source of furs, but trapping is becoming a vanishing industry. It has been claimed that with the application of intensive methods the animals are being exterminated more rapidly than they are multiplying. Squirrel, sable, hare, ermine, bear, marten, and fox are some of the more important varieties.

The fisheries hold out the promise of expanding enterprise. Even where this resource has been partly exhausted there are opportunities for restoring the resource. The leading fish are salmon, herring, and cod. Lobsters and crabs of "extraordinary size" are found along the Siberian coast of the Japan Sea. The waters produce also oyster, shrimp, trepang, and to some extent fur seals, sea beavers, and whales.

CHINA

In a previous chapter we have given some idea of certain resources of China. We may now study the development of the country as a unit.

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[9] *Siberia,* Trade Promotion Series, No. 36, p. 23.

Until about 60 years ago China was practically closed to the outside world. One of the significant features in her foreign relations since 1850 has been the effort of European nations to gain an entrance to Chinese territory for the purpose of trade. In 1793, the British government sent a mission to China and obtained permission to carry on trade at Canton, subject to Chinese restrictions. At the close of the Opium War (1840-1842), Great Britain secured further trade concessions. Canton, Amoy, Foochow, Ningpo, and Shanghai were opened as treaty ports. Foreigners were permitted to reside in these places and to carry on trade, and Hongkong was ceded to Great Britain. During the second war (1856-1860), in which France participated, China yielded further commercial privileges. The country granted the right of residence to ambassadors; Kowloon, opposite Hongkong, was ceded to Great Britain, and Tientsin was opened as a treaty port. More ports were opened after the Tientsin massacre in 1870. Antiforeign sentiment has often resulted in clashes between China and foreign powers, the inevitable outcome of which has been further concessions. As an outcome of the Japanese war (1894-1895) China was compelled to recognize the independence of Korea, to give up Formosa, and to open more ports. In 1897 Germany seized Kiaochow. Meanwhile, Russia forced China to lease Port Arthur. The Boxer War (1900) was a desperate effort to put a stop to the growing demands of foreigners.

The internal political troubles of China during the last quarter century were partly the result of hostility to the conservative policy of the old régime, and were partly due to restlessness growing out of foreign aggressions. No doubt, military leaders in the home country have often been inspired by selfish motives and this has been a cause of trouble.

Although the factory system has begun to make progress in a few industries, this system plays an insignificant part in the industrial life of China. Most of the work of providing the people with food, clothing, and housing is done by hand methods. The limited railway mileage of the country signifies that a vast amount of physical labor falls on the shoulders of human beings in transporting goods. Recent revolutions have proved a serious setback to industry. One of the first requisites for industrial progress is a peaceful and a stable government. Much of the capital which is to develop resources and expand industries must be obtained from the outside, for the reason that domestic savings accumulate very slowly, due to the present poverty and industrial inefficiency of the majority of the people. And a requirement of foreign investment is stable conditions. Before any considerable development can take place China must be supplied with practically all the facilities for trade—commercial banking and means of storing, insuring, and transporting goods. In addition, merchants and manufacturers must be freed from some of the burdens of taxation. Meanwhile, the introduction of a modern industrial system encounters the opposition of certain old institutions, such as the resistance of trade and craft guilds to innovations. But of much more importance there is needed a "change upon the part of the Chinese public toward the institution known as 'face' which discourages young men of education from engaging in pursuits involving manual labor or from accepting positions of a subordinate character; in other words, the recognition by society that a young man may start at the bottom of the ladder and work up without entailing loss of 'face'."[10]

The people of China make their living mainly from the field. Farms are small and the system of cultivation crude. The country produces large quantities of wheat, rice, soybeans, tea, silk, millet, peanuts, grain sorghums, cotton, sesame, sugar, and tobacco. Because the population is large, most of the food products must be consumed at home. Silk is the principal export, but China ships abroad a considerable variety of goods including raw cotton, cotton piece goods, pongees, soybeans, bean cake, fresh eggs, albumen and yolk, tea, bean oil, and peanut oil. Exports also include carpets, rugs, embroideries, porcelain, firecrackers, furniture of rattan, reeds and sea grass, hair nets, mattings, paper, straw braid, and many other articles which are more or less characteristic of the enterprise of the country.

The effect of the new artificial silk on Chinese industry and trade in the natural product is a question for the future to decide. The trade in tea, in which China once possessed a monopoly, is now shared with other countries, notably with India and Ceylon. The impression prevails among many consumers that the Chinese product is inferior to that of India. Chinese tea is not grown by the plantation method, nor is it prepared for market by mechanical methods, as is the case with the product from India and Ceylon. But Chinese authorities insist that the hand methods are a point in favor of the Chinese product. In China, "the tea leaves are picked by women and girls three or four times during the season. The leaves are withered in the sun after picking and then fired over charcoal fires. In the case of green teas the leaves are roasted almost immediately after they are picked, rolled into balls by hand to crack the veins and set the acids, and then dried quickly."[11] The oolong teas require a more elaborate method of preparation. Occasionally, Chinese teas are scented with extraneous products such as the petals of the jasmine or gardenia. But, as a rule, the high-grade teas are not treated in this way. Whatever happens to the foreign market, China possesses an immense home demand, for tea is a commodity of universal consumption.

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[10] *China,* Trade Promotion Series, No. 38, p. 264.

China possesses a wide diversity of mineral resources, but in view of the enormous prospective needs her stores of coal, petroleum, and industrial metals are none too great. The coal resources have been estimated at from forty to fifty billion tons, and iron ore at 950,000,000 tons. Neither of these resources has been adequately surveyed and the country may contain much greater reserves. China possesses also considerable supplies of petroleum, but as yet very little has been done to develop the industry. The known supplies of copper are far below future needs, and this is true also of lead and zinc. On the other hand, the country possesses large supplies of tungsten and molybdenum, and at times is one of the largest exporters of the former metal. The mines contain, also, tin, mercury, and manganese, but the reserves are not large in view of future requirements.

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[11] *Ibid.*, p. 242.

JAPAN

Japan, like China, was practically closed to the outside world until recent years. On a former page we have referred to the early treaties by which the United States and Great Britain were admitted to trade with the country. The provisions of these treaties were extended in 1858, and during the next twenty years Japan entered treaty arrangements with eighteen nations.

Japan had already developed certain industrial arts to a high degree before contact was established with foreign countries. This was the case with pottery, lacquer ware, metalwork, *cloissonné,* wood and ivory carving, and the production of paper, textile fabrics, and embroidery. The industrial habits were already developed and it required no great effort for the workers to adjust themselves to factory methods. In recent years Japan has made rapid progress in the introduction of machine and power methods, although many of the old crafts remain and workers still produce the characteristic products, following the arts and methods which have come down by tradition. In 1924 about 1,700,000 employees were employed in the manufacturing enterprises of Japan. Such enterprises include the manufacture of the textiles—silk, cotton, and wool—iron and steel, machinery, foodstuffs, and chemicals.

The population of Japan has grown rapidly in the last fifty years, and is still increasing at a rather rapid rate. From about 34,000,000 in 1878 the numbers have become 59,000,000, for Japan proper, in 1925. About half this population lives in the cities of over 5,000. Japan is far in advance of the other eastern countries in interest in education. Elementary-school training is compulsory. Over 9,000,000 students were in the elementary schools in 1923-1924; over 180,000 students were in the technical schools; and about 52,000 students were attending the colleges and universities.

To make provision for the growing population, with respect to both food supply and occupation, is one of the important problems of Japan. The country is already a large importer of foodstuffs, with the immediate prospect of being forced more and more to resort to the import trade for additional supplies. The land available for cultivation is relatively small—only about 16 per cent of the total area—which for Japan proper amounts to 147,000 square miles. Intensive methods of cultivation are necessary, but there is a limit to the application of this system. One proposed solution to the question of food supply is the intensive colonization of Hokkaido, one of the northern islands of the Japanese group. But even this measure will offer only temporary relief. Rice is the most important cereal crop, but Japan produces some wheat, barley, and rye. Tea and tobacco are among the products of agriculture, and the production of silk is an important enterprise both from the point of view of domestic needs and the export trade. In fact, silk is the largest single export of the country.

Japan is inadequately supplied with coal and iron. Chosen and China supply considerable quantities of iron ore, and in addition, Japan imports iron and steel in the form of bars, rods, plate, and sheets. Copper is one of the most important resources. The country produces from 60,000 to 70,000 tons a year. But, on the other hand, Japan is an importer of lead and zinc. Japan produces gold, silver, graphite, sulphur, and small quantities of petroleum. With the further development of her manufactures this country will depend more largely on the outside world for textile fibers, except silk; for industrial metals, except perhaps copper; and for fuel; and the great problem will be to find a means of payment for the imports.

QUESTIONS

1. Why is Asia, which contains some of the oldest populated areas in the world, industrially backward?
2. Why are railroads not built more rapidly in the densely populated areas of China?
3. What traits of character in the Turks make for slow economic progress?
4. Explain how the land system of Turkey has held back development.
5. State the leading industries of Persia. Why has this country lost its ancient position as an enterprising nation?

6. What are the leading resources of Siberia? Estimate the future of this country with respect to (*a*) agriculture, (*b*) forest industries, (*c*) manufacturing. What are the chief industrial needs of this region?

7. Give the principal features in the development of China in the last 70 years.

8. Give an estimate of the industrial future of the country.

9. Why has the modern industrial system been introduced more rapidly in Japan than in China?

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CHAPTER XXXII

THE ECONOMIC PROSPECT: SUMMARY AND CONCLUSION

By way of review, several features of the present world economic organization attract attention. In the first place, industrial progress, as this term is understood in the western world, is of recent origin. The beginnings of the movement which converted the United States and the western countries of Europe into industrial nations dated from about the middle of the eighteenth century. But more than one hundred years elapsed before this movement acquired momentum, which brought these nations to the state in which they exist today. In fact, we can designate the year 1880 as the approximate date of beginning of the latest phase of the new industrial era.

This is most obvious in the case of the United States. From 1880 to 1920 the output of mineral products in this country increased about nineteenfold, of iron nearly tenfold, of copper about sixteenfold, of coal nearly tenfold, and of petroleum nearly fortyfold. More than one hundred years were required to bring the industrial nations to a stage of development in which they could make rapid progress. This signifies that this period was required to accumulate the industrial capital, to organize industrial forces, to build up the economic organization, to develop the industrial skill and to train the workers. Once these conditions had been satisfied, progress was extremely rapid. This signifies that the draft upon mineral resources during the last fifty years has been enormous. In this brief period the nations have consumed more coal, iron, copper, and petroleum than in many preceding centuries. Herein is the fear concerning the exhaustion of resources and the reason for the appearance of the conservation question.

It is obvious from what has been said in former chapters that this economic progress has been very unequally distributed over the world. Factory systems of production exist chiefly in a few nations in western Europe and in the United States. Here and there, this method of manufacture has been introduced in other regions, but it exists only on an insignificant scale compared with the magnitude in the regions just mentioned. The industrialized sections are now the centers from which flow the capital and enterprise which are reconstructing the world on the new industrial model. Here the surplus capital originates, and here are the trained men—bankers, merchants, manufacturers, and technical experts—who understand the modern industrial arts and who supply the energy and the knowledge for the introduction of this type of enterprise into other parts of the world. At this point we do not attempt to express approval or disapproval of the spread of the industrial system; we merely indicate what is taking place

Another economic feature which is now understood from the discussion in former pages is that nature has not distributed her resources evenly over the world. This is particularly the case with the nonreproducible materials such as coal, iron, petroleum, copper, lead, and zinc, and it is much more the case with some of the rarer metals. Political boundaries were no part of nature's scheme, with the result that some present nations are poorly supplied with industrial minerals, while others possess ample supplies. The shortages of the nations must be made good by trade, and in many instances industrial combinations which cross several national borders are the only means of obtaining a satisfactory industrial organization, as with the agreements and cartels in various European countries. Differences in resources are of course a prime case for trade, but in recent years they have become the motive for international combinations. Climatic and topographical conditions also create differences in products, but the nations are much more adequately supplied with field resources than with those from the mines. Great differences exist, however, in the products of the various climatic zones. Tropical products are required by every nation, and in many instances an extensive trade organization has been built up to assure the consuming regions of adequate supplies.

Many of the original natural differences in field products have been equalized by the transfer of products from one area to another. Many of the great raw materials of commerce are now grown outside their original habitats, as with tobacco, corn, coffee, cacao, and rubber, to name only a few products. The migrations of peoples have been great factors in distributing the production of valuable field industries, and the conscious efforts of governments and of capitalistic investors have contributed to the same end. Not infrequently a transplanted industry prospers to a greater extent in its new home than in the old, as with rubber and coffee.

A most significant feature of recent world economic development has been the great increase in foreign investments. This enterprise is a great force in opening new resources, and in developing trade with many of the poorer parts of the world. Such investments are used to build railroads, improve ports and harbors, open mines, develop plantations; to finance manufacturing and commercial enterprises; and to develop trade facilities of every description. Foreign investments are a cause of commercial development for the reason that they open new regions and supply commodities for trade. The investment often takes the form of exports of machinery, tools, railway materials, and merchandise. And, on the other hand, the returns on the investments are often made in the commodities which the borrowing country is able to produce. Thus, such investment stimulates both the export and the import trade of the lending country.

EASTWARD THE STAR OF EMPIRE

Whatever direction the migration of peoples may have taken, the star of economic empire is moving to the East and to the South. The region of highest economic development is in the United States. Here the manufacturing industries have been more extensively developed than elsewhere in the world, and here, also, the economic organization is better coördinated than in any other industrial nation. Wealth accumulates more rapidly. The output per man and per machine is greater, and the standard of living is on a higher level. Western Europe ranks next in the attainments of industrial progress; but the intensity of industrialization shades off, towards eastern Europe. The industrial areas in the western world are the main sources from which the new industrial energy is distributed to the East and South. The older, and the more backward, regions are being gradually transformed by this flow of liquid capital; of machinery and tools of every description; of personal skill of those who direct industry; and of facilities for the development of mine, factory, and trade. Whether for better or worse, both the economic systems and the political institutions of the western countries are penetrating into many parts of the world.

THE CLASH OF STANDARDS

There may be some truth in the statement that "East is East and West is West and never the twain shall meet." But if this quotation describes mental attitudes it must be added that these mental attitudes are not immutable. Even in those parts of the world where institutions seem to have solidified under the deadening influence of custom and tradition, change is beginning to take place. Moreover, there is probably a great deal more similarity among the peoples of the East and West than superficial observers are willing to admit. Mental states are not immutable. They are changing. The "modernizing" of Turkey, the penetration of western ideas into China and India, the stimulation to gainful effort of even the black men of Africa are sufficient indications that all parts of the world have something in common, namely, the desire to improve material conditions. And it is not unlikely that the ancient systems of philosophy and religion which have been mainly responsible for holding people to fixed standards of life will be thrown into confusion by the intrusion of the new industrial ideas, just as the western world, since the rise of industrialism, seems to have lost its philosophy, if not its capacity for philosophizing.

As with everything else in life, the clash of standards is a passing phenomenon. The paramount good is social improvement in which all classes may participate. This ideal is making its way around the world. Nations and people may differ in methods, but not in the economic goal to which efforts are directed.

ECONOMIC PROGRESS

What is the goal to which these efforts are directed? In other words, What is economic progress? If one seeks fixed, immutable standards with which to test progress the search will be in vain. To say that it means "development," or "evolution," or "achievement" means nothing, because one raises the question: What is the measure of development? What are its qualities and dimensions?

> [The] test of progress is found in the judgment of the people, as well as in changes in material things. In the last resort the people of the times decide what constitutes their progress and there is no other court in which the case may be tried. The thinkers of another century may pass quite a different judgment, as we know full well from the opinions we hold of the civilizations of the past. Judgments are ephemeral. With the passages of centuries will come more facts and relations and different methods of reasoning about them. But no liberal person will venture to say that the judgment of any people, in any time, is immutable and final.[1]

Purely from an economic point of view, the people who have come in contact with the modern economic system place value on a great variety and abundance of commodities and services. In fact, this is one of the tests by which they measure welfare. What they desire is an increase in all forms of wealth with the greater satisfaction which flows from this condition. Wide diffusion of social well-being, more physical comforts, less grueling labor, more certainty of livelihood, and greater participation in the fruits of invention and discovery are the goals which industrial people set for themselves. They regard the achievement of these goals as economic progress. Wherever the modern economic system has touched a people they take up with these tests and standards. Thus, one of the first steps of a backward people, when they establish contact with the new industrial system, is to give encouragement to education, and this includes not only the so-called cultural studies, but instruction in the trades and vocations. They try to develop the ideas of thrift and saving.

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[1] I. Lippincott, *Economic Development of the United States*, 2nd ed., p. 744.

They study more effective systems of production, and they adopt governmental policies to foster and encourage industrial expansion.

On the purely mechanical side, there is no question that progress has taken place. One means for rendering living more easy and comfortable is the improvement of tools, machines, and equipment of every description. On this score no one can gainsay the fact that economic progress has taken place. We may take an illustration from the development in the United States. The increasing use of power devices is one of the most significant features of our industrial growth. It indicates the substitution of some other energy than that of human muscles, and indicates a gain in the natural forces applied to industry. It signifies, also, a better application of power than would be possible with unaided human labor. Thereby, both the sum total of industrial energy is increased and more effective use of power is obtained. The extent of this development in the United States is shown by the fact that the use of primary horse power employed in the manufacturing industries increased from 2,346,000 in 1860 to 29,422,000 in 1920.

And this does not tell the whole story of the application of power. In transportation both by rail and by water, in mining and quarrying, and in agriculture, power machines driven by steam, or by petroleum oils, and by electricity have added enormously to our capacity for production. In mines and quarries, for example, the aggregate horse power amounted in 1919 to 6,723,000. In rail transportation in the United States in 1922 there were over 68,500 locomotives with a total tractive power of more than 2,400,000,000 pounds. This represents an enormous gain over the transportation systems which employed men and animals as the means for carrying freight. Similar developments have taken place in the other industrial countries, but not to the same extent as in the United States. But the vast majority of the people of the world still labor by the hand system, unaided by power devices, and in many cases the great burden of carrying freight is done in one way or another by man power. In time, it will become a part of their goal of progress to relieve themselves of these unnecessary burdens.

There can be no doubt, also, that increasing control over natural forces is one test of economic progress. If modern transportation systems had performed no other service than that of relieving the densely populated areas of the threat of famine, as with India, it would justify our test of progress. But it has done much more to contribute to the comfort and to the well-being of the people who are served by such instruments.

Growing control over natural forces has been notable in agriculture. In the more advanced countries, farmers have learned better methods of tilling the soil, better adaptation of crops to soil and climatic conditions, and they have learned to use better implements of production. Many of the farming operations are now performed by machinery; agricultural science has revealed methods of preventing, or at least of reducing, many of the losses due to weather and insects; agriculture has been greatly diversified; many new crops have been introduced; products that were indigenous to a few parts of the world have been introduced into many regions; the development of systems of marketing, storage, and insurance have rendered this industry less precarious and more profitable than in former days.

In addition, modern systems of production are often based on economies in the use of materials, the use of by-products, and the development of substitutes, which in some cases are better than the natural products, as in the case of aniline dyes. Diversified production and consumption have added not only to the comfort of consumers, but to the certainty and regularity of labor. The various protective devices which have been built up by modern industrial society are other indications of our concept of economic progress—such, for example, as systems of insurance, accounts in savings banks, and home builders' associations, to name only a few. One of the great problems of the future is to spread the benefits of these economic achievements to the less fortunate people.

THE NONREPRODUCIBLE RESOURCES

Whither will this economic progress lead? There are certain ultimate limits beyond which economic growth cannot go—at least as long as we are kept moderately within the limits of our present expectations of the future. These limitations refer partly to physical resources, and partly to the capacity of the human resource. Specialization and division of labor are among the great features of the present industrial system. In a large measure our economic progress has been made possible by the applications of such systems. But there is a limit beyond which division of labor cannot be carried, namely, when it has been extended down to the elementary motions or occupations. When a job or an occupation has been split into these elementary parts the division of labor can be carried no further. In fact, the limit is reached before the task has been divided into elementary parts, due to the fact that in practice a business organization cannot coördinate effectively a large number of simple tasks.

In the case of natural resources, limitations are of another kind. We may divide natural raw materials into two capital classes: (*a*) those that are reproducible; and (*b*) the vanishing or wasting resources. The peoples of the future need have little concern about the former. The resources of field, forests, and waters can be reproduced. In fact, there are not only vast areas which may be brought under cultivation, but the productivity of present areas may be greatly increased. There are many present indications that this increase may be accomplished without the immediate intervention of the factors connected with the law of increasing cost. Moreover, contrary to the general run of statements, the land area of the world is not limited, if we mean by that statement the area which may be brought under cultivation. Great areas have been reclaimed by irrigation and by drainage, and still greater areas may be reclaimed by a better adjustment of the agricultural industries to natural conditions. To all intents and purposes, new knowledge as to methods of increasing the yield of crops produces the same result as an extension of land area—under the extensive system.

All in all, the least of the worries concerning the future, is over the products of soil, forests, and waters—that is, the reproducible resources. But the real problem of the future is concerned with the wasting resources—coal, iron, lead, zinc, and petroleum, not to name them all. Here, too, the extent of limitations on production will depend on the future contributions of human genius to the methods of discovering nature's unrevealed stores and the methods of extraction which will make large-scale consumption possible. Exhaustion is a relative term, and one of the most important factors in this relation is the possibilities of science in making new discoveries, and possibly new revelations. The scientist never contends that an achievement is impossible, because science has nothing to do with prophecy. But we can say that if scientific discoveries can keep pace with the growing need for mineral materials we need have no fear of a shortage of the great minerals, or their prospective substitutes.

In our estimate of future demands on resources, we often forget that at present the draft upon the minerals is made by only a small percentage of the world's population. It would not be far from the truth to say that about 20 per cent of the world's people consume annually about 80 per cent of the present annual production of coal and iron, and even a smaller percentage of the world's population are the consumers of the annual production of petroleum. The other portions of the world have not yet reached the stage where they can consume large quantities of iron, coal, and petroleum. If their consumption were on the same level as that of the industrial nations the draft upon nature's reserves would be much greater than it is today, and exhaustion would occur in the near future. Possibly, in a hundred years, when the more backward countries have caught up with the advances of the industrial system, the problem of supply of industrial metals will become an alarming question.

This applies more to iron than to any other metallic substance. Mechanical industry depends absolutely upon this metal, and at present there is no prospect of discovery of an adequate substitute. The condition is made more critical because of the fact that in many of its uses iron must be exposed to weathering processes which result in enormous annual losses. There is enough preventable waste of iron, but a very considerable portion of the waste cannot be prevented because of the nature of the use, as with much of the railway iron. The dependence of the industrial world on iron is shown by the fact that it makes possible our transportation systems, and our machine industry, and it is also essential for our modern methods of construction. The future of power resources is far less critical than that of the industrial metals. It is true that the stores of mineral power substances are not unlimited. Petroleum is probably much nearer exhaustion than most people realize, and although the coal reserves are large they are not abundant in view of future demands. Coal and petroleum, however, are not the only power resources. Many parts of the world contain great supplies of water power. It has been claimed that the energy contained in the undeveloped water-power resources of the United States is about equal to the energy contained in our annual output of coal. And there are even now promises of other sources of power than those contained in coal, petroleum, and waterfalls. But, in the last analysis, power must be used in connection with devices constructed with iron and copper. The supply of these metals, therefore, which are the materials for dynamos, motors, and other machinery, contains the key to the future of industrial progress.

Thus, in conclusion, we may raise the question whether the industrial age is merely a passing phenomenon. Epochs, or eras, are not necessarily measured in decades. Sometimes several centuries are required for a movement to run its course; sometimes even a longer period. But historical epochs have come and gone. Each has been characterized by certain outstanding features, as our own is characterized by the extensive use of machines, by power devices, by specialization and division of labor. But progress based upon these things has its limits and these are determined first by the available sources of materials upon which the system can be built, and by the genius of inventors and discoverers in circumventing possible exhaustion of necessary materials. An enormous burden rests upon the shoulders of all that class that is known by the more specific titles of inventors, discoverers, engineers, entrepreneurs. Our salvation rests as much with them as with the materials which nature still has stored beneath the surface.

REVIEW QUESTIONS

1. Give the leading resources and the development (including agriculture and manufactures) of the following countries:

(*a*) Great Britain
(*b*) France
(*c*) Switzerland
(*d*) Italy
(*e*) Balkan States
(*f*) Germany
(*g*) Belgium and Holland
(*h*) Norway, Sweden, Denmark

2. Do the same for the Asiatic countries:

(*a*) India
(*b*) Malay States
(*c*) Malay Archipelago
(*d*) Japan

3. Do the same for Australia and New Zealand.

4. Give the chief resources and exports of the countries of the north of Africa.

5. Do the same for the South African Union.

6. State and explain the leading factors in the industrial development of Great Britain. Does the history of Great Britain show that abundant and varied local resources are necessary for growth of manufactures and commerce? Give proof pro or con.

7. What raw materials does Britain import chiefly at the present time? From what sources does she import them chiefly?

8. To what extent are the resources of Britain (mineral and field and forest) adequate to her present needs?

9. Explain how the following have promoted the growth of British industries:

(*a*) Shipping facilities (merchant marine)
(*b*) Widespread financial connection (banking facilities)
(*c*) Mercantile organization
(*d*) Foreign investments of British capital
(*e*) Colonial possessions

10. What evidence is there that colonial possessions are one of the largest factors in the supremacy of British foreign trade?

11. What has been the tendency of British foreign commercial policy during the last hundred years?

12. State some of the peculiarities of specialization in British industries. Are her industries integrated like those of the United States? Why?

13. What are the leading exports of Great Britain?

14. What advantages does Britain possess for manufactures? How many of these advantages will persist? Will any disappear in time? Will this affect her manufacturing position?

15. Give the chief industries and resources of Scotland, Wales, Ireland.

16. Within what countries are the world's chief supplies of:

(*a*) Coal
(*b*) Iron
(*c*) Petroleum
(*d*) Copper

17. What advantages does France possess for industrial development? How do you account for her development in the past?

18. Do French products compete in the foreign trade with those of other countries? Why or why not? What effect does this situation have on her manufacturing development and on her foreign trade?

19. What are the chief products of French agriculture? Describe the land system of France and explain what effect it has on the agricultural development of the country.

20. What are the world's chief sources of vegetable oils?

21. How is olive oil prepared for the market? What are some of the chief by-products of the industry and what are they used for?

22. Account for the industrial backwardness of:

(*a*) Spain
(*b*) Italy
(*c*) Balkan States

23. How is cork harvested and prepared for the market? What are the world's chief sources of cork?

24. State and discuss the following with regard to European agriculture: (*a*) chief crops and where they are grown; (*b*) the land systems of the various countries, noting the differences; (*c*) general features of their agricultural methods with a contrast with the United States.

25. In what countries of Europe is the factory system most developed? In what countries the least development? Where does the domestic system prevail? Account for these differences.

26. What conditions are necessary for the industrial development of Asiatic Russia? Estimate the possibilities for industrial development in this region.

27. Describe the chief industries of the Iran Plateau. What is the economic basis for these industries?

28. Give the essential facts about the manufacture and marketing of Oriental rugs.

29. Estimate the possibilities of the industrial development of China in the near future, giving the basis for this estimate.

30. What are the following products and where are they obtained?

(*a*) Tussur silk
(*b*) Chinchona
(*c*) Copra
(*d*) Jute
(*e*) Pulse
(*f*) Opium
(*g*) Pepper
(*h*) Nutmeg
(*i*) Alfa (espart)
(*j*) Cinnamon
(*k*) Mustard
(*l*) Jade
(*m*) Teak
(*n*) Cloves
(*o*) Mohair
(*p*) Bamboo

31. Estimate the possibilities for industrial development in India giving the economic basis of the estimate.

32. Do the same for Australia and New Zealand.

33. What countries will be the future great granaries of the world?

34. What are the chief textile fibers, and whence do they come?

35. What commodities do the North African countries, including Egypt, supply to the commerce of the world?

36. What countries are at present the chief producers of the following:

(*a*) Iron and steel
(*b*) Cotton and woolen goods
(*c*) Linens
(*d*) Silk
(*e*) Cutlery
(*f*) Wines
(*g*) Olive oil
(*h*) Leather
(*i*) Timber

37. What parts of the world supply the following:

(*a*) Wool
(*b*) Cotton
(*c*) Dates
(*d*) Cork
(*e*) Diamonds
(*f*) Coffee
(*g*) Tea
(*h*) Spices
(*i*) Rubber
(*j*) Jute
(*k*) Teak
(*l*) Rice
(*m*) Ivory
(*n*) Gold
(*o*) Sponges
(*p*) Ostrich feathers
(*q*) Platinum
(*r*) Tin
(*s*) Oil seeds

38. What products do the following names suggest:

Wilton
Sheffield
Doulton
Worcester
Manchester
Lancaster
Nottingham
Billingsgate
Dogger-Bank
Limoges
Lyons
Le Creuzot
Straits Settlements
Cambrai
Valenciennes
Oporto
Jerez
Leghorn
Almadén
Zante
Malaga
Bilbao
Delft
Smyrna
Cashmere
Kimberley
The Rand

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